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AMERICAN HEALTH PRIMERS.

THE

MOUTH AND THE TEETH.

BY

J. W. WHITE, M.D., D.D.S.,
Editor of the Dental Cosmos.

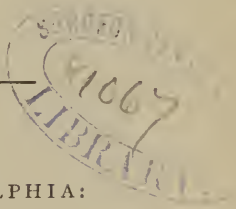

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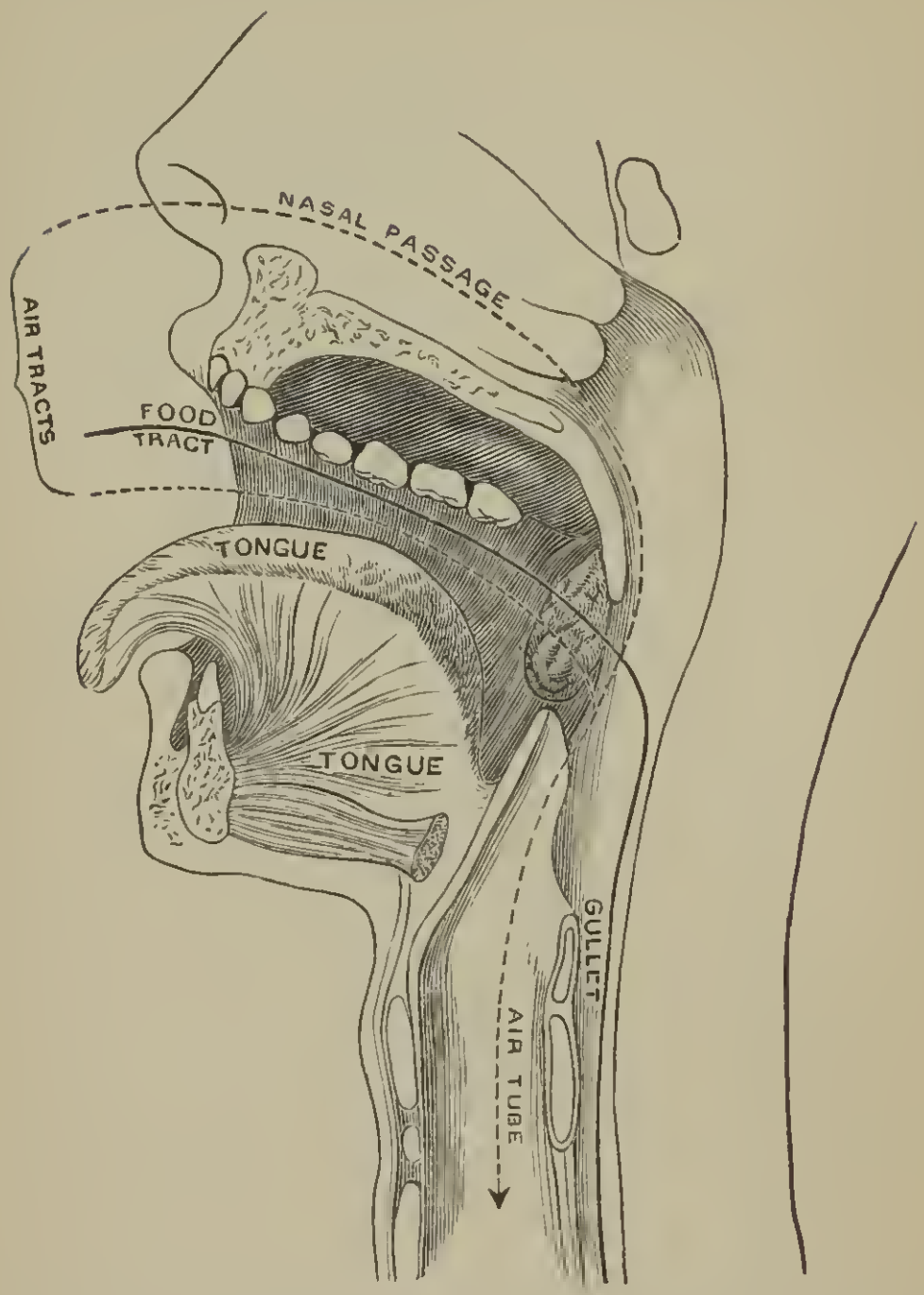
DIAGRAM OF FOOD AND AIR TRACTS.



The solid line through Mouth and Gullet represents the course taken by food and drink; the dotted lines through Mouth, Nasal Passages, and Air-Tube represent the course taken by the air.

[From *Cohen on Throat and Voice.*]

THE MOUTH AND THE TEETH.

CHAPTER I.

INTRODUCTORY.

THE mouth is not only the most expressive and characteristic, but it is also the most important, of all the features. No other portion of the human organism is of such complex structure, and no other has such diversified functions to perform.

The preservation of the health of the mouth is essential to the general well-being. Disease of the body involves an unhealthy condition of the mouth, and is manifested by perceptible changes in the tongue, gums, lips, and mucous membrane. On the other hand, it is reasonable to conclude that an unhealthy condition of the mouth will act prejudicially to the general health of the organism. The breath, if made offensive by a diseased state of the mouth or teeth, cannot be wholesome when inhaled into the lungs and brought into contact with those delicate structures, the air-cells; nor can it exercise the best

influence upon the blood, which depends in great measure for its quality upon the purity of the air supplied to the lungs. Moreover, it is very undesirable to transmit offensive matters into the stomach, as vitiated saliva or food polluted by noxious secretions.

The value of a good set of teeth — a complete and perfect "denture" — is not to be computed, if only the service of dividing and masticating the food be considered; mastication being the first step in a series of processes by which the food is transformed into nourishment adapted to the needs of the system. When to this consideration we add their importance in assisting vocalization — distinctness of utterance in speech and song — and the necessity for their preservation in order to maintain the natural symmetry of the features, it would appear to be a positive duty that every one should study to avoid the causes which tend to the premature destruction of the teeth.

There is abundant reason for an effort to awaken a general interest in the prevention and arrest of the process of decay in human teeth. That there has been a progressive deterioration in the quality of the dental outfit of mankind through successive generations, is claimed by many observing practitioners of dentistry. There can be no doubt that dental caries is on the increase — is well-nigh universal; while recession of the gums and absorption of the support-

ing alveolar processes are fearfully prevalent, even in the mouths of the young. If these tendencies are to be successfully combated, it must be not alone nor chiefly through the manipulative skill of dental operators, but through a better appreciation by the people of the causes of the deterioration and of the means by which it may be counteracted. The importance of a wide diffusion of information in regard to these matters has been recognized by every intelligent dentist. It is high time that more attention be given to the subject.

Matters of much less importance to personal appearance, of vastly less account to individual comfort, and beyond all question of smaller moment to health and life, are made the subjects of constant study and care; while the amount of information possessed by the public in this direction is lamentably small, and much of that is erroneous. Many otherwise intelligent people are sadly deficient in a proper comprehension of this subject. There are no other organs of the body which are not more appreciated than the teeth, and yet there are none the neglect of which entails more serious results.

It is estimated that twenty millions of teeth are annually sacrificed in the United States. The criminal neglect thus exhibited involves not only this waste of teeth, but is the fruitful cause of abscesses, facial deformities, neuralgias, dyspepsias, headaches,

eye and ear troubles, and other morbid conditions. Protracted derangements of sight, of hearing, and of the general health not infrequently have their unsuspected origin in the mouth.

For these reasons, the facts relating to the formation, structure, development, eruption, character, functions, and diseases of the teeth, and to the preservation of their health and that of the associated parts, should be better and more generally understood.

In the hope of awakening interest and stimulating thought with reference to the intelligent care of the mouth this monograph has been prepared.

CHAPTER II.

THE MOUTH.

THE mouth is the organ of taste, of speech, of song, of mastication, and of insalivation; the avenue for the entrance of the food and drink essential to life, and the channel through which passes much of the air which is inhaled, as well as that which is expired. The same membrane which lines its cavity is continued throughout the nose, the throat, the stomach, and the intestinal canal; throughout the larynx, the windpipe, the bronchial tubes, and the lungs. It is thus closely related to the functions of digestion and respiration, while by open passages direct communication is maintained with the eyes, ears, and nose, and by the nerves, with which it is abundantly supplied, with every part of the body.

The mouth is made up of the lips, cheeks, upper and lower jaws, with their alveolar processes; the hard and the soft palate, the tongue, salivary and mucous glands, mucous membrane, gums, and teeth. It is a wonderful combination of bones, muscles, arteries, veins, nerves, glands, membranes, and a cu-

rious structure of hard and soft tissues constituting the teeth. These, like all other parts of the body, depend upon the general system for their development and nourishment.

The lips, which are fleshy folds surrounding the orifice of the mouth, and the cheeks, with which they are continuous, forming the sides of the face and the boundaries of the mouth, are composed of true skin externally and mucous membrane internally, between which are the muscles which produce their movements; also, blood-vessels, nerves, and small bodies called mucous glands, having ducts or tubes opening by minute orifices upon the inner or mucous surfaces. These glands secrete a fluid which helps to lubricate the mouth. (By the terms "secrete" and "secretion," as here used, is meant a process by which various matters derived from the blood are collected and discharged at particular points in order afterwards to be employed for special purposes in the economy.)

The palate or roof of the mouth, well shown in the *Frontispiece*, consists of two portions — the hard palate in front, and the soft palate (called the *velum*) behind it, terminating in a central pendulous structure — the uvula, commonly but erroneously called the palate. The hard palate, which is a bony plate, is covered by a dense tissue called the periosteum (*around a bone*). The soft palate is a soft, movable fold or curtain of mucous membrane, inclosing muscular

fibres. It serves important purposes in the mechanism of the mouth, assisting materially in the articulation of sound, in the act of swallowing, and, conjointly with certain muscles connected with it and with the tongue and pharynx, preventing the passage of food into the nose, which opens into the upper part of the throat above the soft palate.

The tongue is a muscular body lying on the floor of the mouth within the lower dental arch. It is covered by mucous membrane, beneath which are mucous glands having orifices opening upon its surface. It is the organ of the special sense of taste, and presides over the processes of mastication and swallowing. The exquisite sensibilities of touch and taste residing in the tongue are important aids in mastication. Its sense of taste informs us of the qualities of the food, and its sense of touch recognizes its physical condition — consistency, size, form, and when it has been sufficiently masticated. By its muscular structure it collects and moves the food from one side of the mouth to the other, and, with the aid of the lips and cheeks, keeps it between the masticating surfaces of the teeth. When the food is in a sufficiently softened condition, the tongue collects it upon its upper surface and passes it backward into the pharynx — a funnel-shaped canal situated on the middle line in front of the spinal column, between the base of the skull and the esophagus or gullet — which serves as a common origin for

the digestive and respiratory tracts, giving passage to the air during respiration and to the food at the time of deglutition or swallowing. By virtue of its complicated muscular structure the tongue is also capable of the great variety of movements essential to suction and to speech. At the base of the tongue is a cartilaginous oval or triangular flap called the epiglottis, its apex attached, the other and larger part free. Its special use seems to be to cover the glottis (an aperture in the larynx or the apparatus of voice, situated at the top of the trachea or windpipe), and thus prevent the passage of food into the air-tubes. The tongue sympathizes with all derangements of the general system — especially with those of the alimentary canal. As an index of the state of the general system, it affords, doubtless, more varied information than any other single means of judgment. Its bulk, color, dryness or moisture; the character of its surface, of its coatings, and of its movements show to the skilled observer the degree, progress, and stage of systemic derangement. The tongue is liable to a variety of local diseases and injuries. Among the latter, ulcers, sometimes very serious, are caused by the persistent irritation of the jagged edge of a broken or carious tooth or a projecting root. Similar effects from like causes are also produced upon the cheeks. Whenever such sources

of irritation are recognized, they should be promptly corrected.

Opening upon the mucous surfaces of the mouth are the excretory, or discharging ducts or tubes of three pairs of salivary glands — the parotid, the submaxillary, and the sub-lingual. The parotid glands (so named from two Greek words signifying "ear" and "near" — *near the ear*) are the largest of the three pairs, weighing from a half ounce to an ounce each. They are situated upon the sides of the face immediately below and in front of the external ear. Their ducts lead to outlets, which can usually be readily seen, upon the inner surfaces of the cheeks opposite the second molar teeth of the upper jaw. The glands called submaxillary (*beneath the jaw*) are situated below the lower jaw, and have their outlets on either side of the middle line beneath the tongue. The glands called sublingual (*beneath the tongue*) are situated beneath the mucous membrane of the floor of the mouth, their ducts — from eight to twenty in number — opening under the tongue.

The secretions or products of the mucous and salivary glands differ in character as do those of the latter from one another. They differ also in the quantity of fluid which they discharge, and as to the causes which excite their action. The parotids are called the masticatory glands, because they are not found generally except in animals which are furnished with

grinding or masticating teeth. A larger quantity of secretion takes place from them than from either of the other salivary glands, especially during the movements of the jaw in eating, and particularly on that side of the mouth on which the chewing is being done. When thus stimulated to action they pour out an abundant secretion, which becomes incorporated with the food during mastication, uniting dry particles into a coherent mass. These glands are also active during the movements of the jaw caused by continuous speaking. The parotid gland is the seat of the inflammation in the disease called mumps. The submaxillary glands are more immediately concerned in the sense of taste. They are found only in those animals which subsist on food which appeals to that sense, being almost entirely absent in the grain-eating birds. They are excited to special activity by the introduction into the mouth of sapid (tasteful) substances. The sublingual glands are particularly stimulated by the act of swallowing.

The secretion from the parotid glands is a clear and limpid fluid; that from the submaxillary glands is clear, but thick and viscid; that from the sublingual is thick, glutinous, and ropy. All are slightly alkaline.

The function of the parotid glands is supposed to be to moisten the food, and thus, by the aid of mastication, to give it the requisite consistency and

convert it into a homogeneous mass; that of the submaxillary, to promote the solution of soluble substances, in order that they may make an impression upon the nerves of taste; that of the sublingual, to lubricate the food, and thus facilitate its passage into the pharynx.

The secretion of the mucous glands of the lips, cheeks, gums, tongue, floor and roof of the mouth, is a more or less viscid, transparent, or somewhat turbid fluid, generally slightly acid.

These different and distinct secretions all unite to form the fluid ordinarily termed saliva. This mixed fluid is in health inodorous, insipid, slightly viscid, and generally alkaline, but so slightly as to be detected only by chemical tests; it is composed of water holding animal and various earthy matters in solution. It is this mixed fluid by which the cavity of the mouth is kept constantly moistened — a necessity, if for nothing else, that the parts may be in proper condition for the purposes of speech. Another important office of the saliva is its dissolving effect upon soluble substances introduced into the mouth, thus bringing them into contact with the nerves of taste, which is essential to the enjoyment of food. It also lubricates the surfaces of the mouth and teeth, and thus prevents the adhesion of food to them. In consequence of its glutinous and frothy character, it imprisons innumerable globules of air along with the

food with which it becomes mixed, thus tending greatly to favor the subsequent solution of the latter by the fluids of the stomach. It also coats the masses of food when ready for swallowing, thus favoring their easy transmission to the stomach. To these varied offices must be added another — a certain chemical effect upon the food (changing starch and cane or crystallizable sugar into grape or uncrystallizable sugar), which is the first step in the series of chemical processes (digestion) by which the food is prepared for the uses of the economy. That the action of the saliva upon starchy foods is of great importance becomes apparent when it is understood that starch as such is insoluble, and would therefore be not only valueless as nutriment, but a positive burden in the alimentary tract, while the sugar into which it is converted by the saliva is readily soluble and nutritious. Still another, and a curious as well as important, result of the slight but constant discharge from the mucous and salivary glands, is its direct influence upon the sense of hearing. Its presence, even when unnoticed and during sleep, causes the act of swallowing at short intervals, which effects the opening of the Eustachian tube (a passage leading from the ear to the throat) and permits the renewal of air in the cavity of the middle ear—a condition essential to the maintenance of perfect hearing. A most interesting provision is shown in the fact that a nerve (the *chorda tympani*),

whose function it is to excite the secretion of saliva, passes through the middle ear, and thus establishes a direct relation between the sense of hearing and the salivary glands, so that certain discordant sounds cause an abundant secretion of saliva, the swallowing of which serves by the constant renewal of air to protect the ear from irritation, as before explained. As a result of other curious nervous connections, the salivary secretion, so essential, as has been shown, to the functions of speech and of hearing, is also stimulated by the sight, smell, or even the thought of savory food. The quantity of saliva discharged into the mouth varies with the condition of the food introduced, being abundant in proportion to the dryness of the food. Its secretion varies, also, with the varying health of the body. It is much diminished and sometimes almost suspended by fear, anxiety, or other depressing emotions. In diseased conditions of the general system its character is variously modified, becoming acid or excessively alkaline; acting upon the soft tissues of the mouth, causing ulcerations of the mucous membrane and recession of the gums; acting upon the hard tissues, causing their disintegration.

Diseased conditions, therefore, of the general system influence unfavorably the health of the mouth, and notably of the dental organism. In febrile conditions there is more or less suppression of

the secretions of the salivary glands, and often a greatly increased and vitiated secretion from the mucous glands, which because of its viscidity collects and thickens about the teeth, entangling with it various extraneous matters and *débris* found in the mouth, its accumulation being favored by the fact that during illness the usual cleansing of the mouth and teeth by thorough rinsing and the brush is neglected; and, as ordinarily at such times there is but slight demand for food, and especially for food requiring mastication, the deposit is left undisturbed and soon undergoes fermentation, becoming strongly acid. Thus it often happens that during a severe illness very serious inroads are made upon the integrity of the structures of the teeth, which are attributed frequently and erroneously to the medicine taken. It follows, therefore, that during sickness these untoward influences should be combated with more than ordinary care. Such care is suggested not only by the rapidly destructive effects of the vitiated salivary and mucous secretions upon the teeth, but by the vicious circle thus established; the products of the deranged action of these glands not only creating local mischief, but causing an irritation of the mucous membrane of the alimentary tract, and by this means, as well as by their presence, resulting in an impairment of the digestive fluids. The exhalations from a diseased mouth may also produce an injurious effect upon the bron-

chial tubes and lungs, and through them upon the blood.

Sometimes, and owing to various causes, such as wounds, burns, abscesses, or dead and ulcerated roots remaining in the mouth, the continuity of the ducts or tubes of the salivary glands is destroyed, and false openings upon the cheek, chin, or throat result. In such cases the secretion is discharged through the false opening, and poured over the external parts. Sometimes also, from similar or other causes, these ducts become obstructed, in which case the secretion, continuing and finding no means of escape, distends the tissues, and forms a soft tumor called a "ranula," generally upon the lip, or upon the floor of the mouth beneath the tongue. Such conditions require, of course, surgical interference for their cure.

The gum is a thin, compact, tough, elastic, fibrous tissue enveloping the alveolar processes, and surrounding the teeth at their necks. It is continuous with the mucous membrane which lines the inside of the lips and cheeks and the floor and roof of the mouth, and at the necks of the teeth with the membrane (called the *pericementum*) which lines their sockets and also invests their roots. In a healthy condition the gum has comparatively little sensibility, bearing without irritation the friction to which it is subjected in mastication. This insensibility is also evidenced by the immunity from pain when the gums are used

in chewing, by the child before the eruption of teeth and by those who have suffered the loss of their teeth.

Fig. I. shows one-half of the upper jaw. The upper jaw — called the *superior maxilla* — is formed by two bones united in the central, or median, line of the face. Each of these bones contributes to the formation of three cavities — the roof of the mouth, the outer wall and floor of the nose, and the floor of the socket (the orbit) of the eye. Each upper jawbone has a triangular-shaped cavity called the antrum (a *cave*); the floor of which is sometimes perforated by the roots of the teeth if they are unusually long. The upper jaw is tightly wedged in by the outer bones of the face, and has no power of motion — the teeth of the upper jaw presenting a fixed surface, against which those of the lower are brought to bear in mastication. That part of the upper jaw which carries the incisor teeth has a separate centre of development, and in early intra-uterine life in man is a separate bone called the "incisive" or "intermaxillary" bone. It remains a separate bone in most adult mammals, but is generally closed

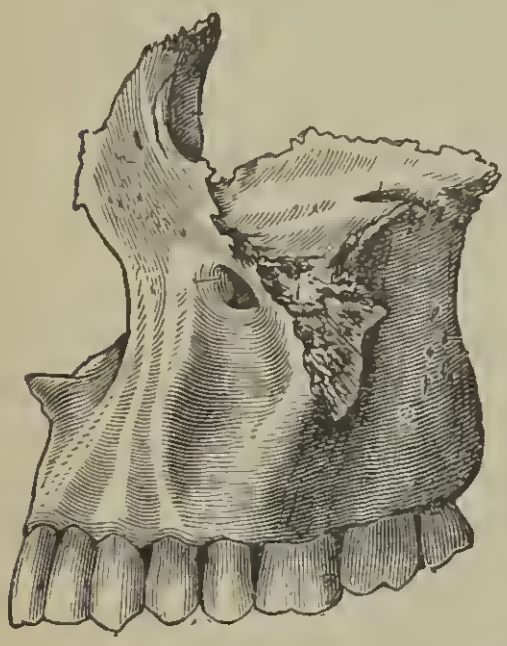


Fig. I.

in man. Occasionally the fissure between this bone and the upper jaw is not closed on one side or both. This deformity is called "cleft-palate." When the fissure is in the lip only, it is called "hare-lip," from its resemblance to the grooved lip of the hare. The anatomical development explains why this is never in the middle line, but always on one side, or in case of "double hare-lip" on both. Hare-lip often exists alone, but where the palate is cleft the lip is apt to be so too, though this is not always the case.

The lower jaw — called the *inferior maxilla*, or mandible (shown in Fig. II.) — is the largest and strongest bone of the face. It consists of a curved horizontal portion (the body), and two upright portions called the rami (singular, ramus — *a branch*). In infancy these upright portions form an obtuse angle with the horizontal portion; in the adult, almost a right angle, the angle becoming again obtuse in old age. It is these modifications in the lower jaw which to a large degree give the characteristic forms to the face in infancy, in maturity, and in old age. Fig. III. shows the

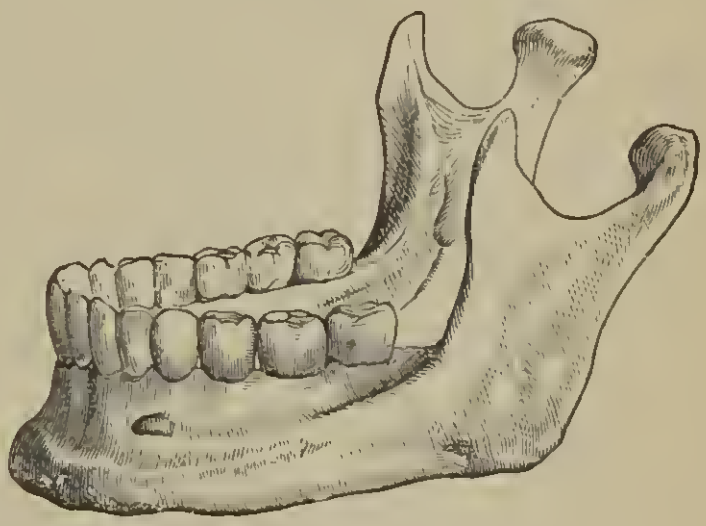


Fig. II.

relative forms of the lower jaw at these three periods of life. A canal of considerable size runs through the body of the lower jaw, giving space for the passage of blood-vessels and nerves for the supply of the teeth. These pass out through openings beneath the bicuspid teeth on either side (shown in Fig. III.), and are distributed to the chin, lower lip, and gum of the lower jaw.

Fig. III.

The closure of the jaws is effected by four pairs of strong muscles — two attached to the outer and two to the inner side of the rami of the lower jaw. The peculiar articulation or jointing of the lower jaw in man allows of a great variety of movements, in keeping with the diversified character of his food, as well as with other and varied uses.

The alveolar processes consist of two plates of bone, an outer and an inner, forming borders to the jaws

and supports to the gums. These are connected by transverse plates, dividing the space into numerous cavities which form the sockets of the teeth. An upper jaw from which the teeth have been recently extracted is illustrated in Fig. IV. The edges of the alveolar processes dip down between the teeth, so that their margin presents a festooned appearance. At the bottom of each socket there is an opening to admit the passage of the blood-vessels and nerves of the teeth. After the loss of the teeth the alveolar processes are absorbed and disappear; so that the roof of the mouth generally loses its arched appearance and becomes nearly flat, and the lower jaw assumes the peculiar form characteristic of old age. When the processes are carious or have been absorbed, the teeth become loose and have to be removed.

Fig. IV.

The pericementum is a tough, fibrous tissue which invests the roots of the teeth and lines their sockets. The cementum or outer layer of the roots receives its nourishment through it. It is owing to this fact

that after the death of its pulp a tooth still possesses a certain amount of vitality, and is therefore retained in its socket, — frequently for years,— which would not be the case if it did not hold a *vital* relation to the jaw. The pericementum, moreover, while attaching the teeth firmly to their sockets, serves as an elastic pad or cushion, preventing to a considerable extent the damaging effects upon the teeth which would otherwise be experienced from accidental blows or other violence, as well as from the thoughtless and unnecessary voluntary injury by efforts to crack nuts, untie knots, and other like foolish procedures.

The movements of the masticatory apparatus of the human being are more complex and more varied than of any other animal, resembling those of both the flesh-eating and grazing species, showing, as does also the comparative anatomy of the teeth, that the human race is adapted to live on a mixed diet. The process of mastication, which is one of very great importance, consists in dividing and comminuting the food by the teeth, reducing it to a state of complete disintegration, which is a necessary condition for its insalivation — the mixture of the food with the fluids of the mouth — and subsequently for the action of the digestive fluids of the intestinal tract. Food is more or less easily digested in proportion as it has undergone thorough mastication. To appreciate this fact, it must be remembered that stomach digestion

is chiefly chemical. It will, therefore, be readily understood that the more finely the food is divided before it is brought into contact with the digestive fluids, the larger will be the surface exposed to their action, and consequently the more easily will it be attacked and the more speedily will it be dissolved, just as any solid is more readily dissolved if first ground to a powder. It is not easy to overrate the importance to the digestive process of a thorough preliminary mastication. Masses of food introduced into the stomach may remain for a long time — days, even weeks — undissolved, disturbing its functions and undergoing fermentative and putrefactive changes, caused by warmth and moisture, creating gases and acids, and, if not expelled by vomiting, becoming a source of irritation and disturbance in its course throughout the whole length of the intestinal tract. In fact, if mastication is not properly performed, the subsequent process of digestion is likely to be deranged. There is no more common cause of indigestion or dyspepsia than imperfect mastication; no more fruitful source of headache, neuralgia, nausea, heartburn, flatulence, cramp, diarrhea, dysentery, and various other disorders. Indigestion, largely induced by imperfect mastication, is the prevailing malady of civilized life — probably the occasion of more disorders than can be traced to any other one cause. The result is, of course, the same, whether the fault

lies in the haste with which the food is swallowed without proper mastication, or whether the masticatory apparatus be defective. There is no question that in many cases an increase of longevity is fairly attributable to the improved facilities for mastication secured by proper attention to the natural teeth, or in case of their loss by the use of artificial teeth. It should be remembered that when, owing to imperfect mastication, the food is passed into the stomach in a crude state, and therefore unfit for digestion, the teeth themselves suffer by reason of the resulting vitiation of the digestive fluids, which by regurgitation exercise an injurious influence upon tooth-structure. Another argument in favor of thorough mastication is to be found in its directly beneficial effects upon the teeth; for, although these organs serve the purposes of vocalization, ornamentation, etc., there can be no doubt that their chief office is the mastication of food. Neither can there be any doubt that the neglect to exercise this special function impairs their vitality, as the disuse of any organ, sense, or structure of the body results in its degeneration and gradual loss of power. A tooth having lost its antagonist — that is, the tooth which opposed it in mastication — will generally elongate or rise beyond the line of its fellows, as though in search of an opposing force; from which it appears that the pressure exerted upon the teeth during use in mastication is essential to their retention

in a healthy condition in the jaws. The teeth are strengthened in their attachments and in their vital relations to the jaws by exercise. There is, therefore, in the case of teeth not properly exercised, a lessened nutritive supply, both through the pulp and through the membrane which gives vitality to the roots. Nor can the use of the brush and powder compensate for the important service which the habitual, thorough mastication of food accomplishes in securing cleanliness of the surfaces of the teeth; the trituration of food effecting that which one is utterly unable to do with the brush. In addition to the offices of the teeth in ornamentation, in their mechanical functions, in their relation to the articulation and modulation of sound, they serve another and important purpose as conservators of the lungs and the organs of voice, preventing the breath in the act of speaking from being exhausted too rapidly. Persons who have lost their teeth find continued speaking, as in conversation, difficult, because each utterance empties the mouth of air, and more rapid breathing is required to keep up the supply. This effort soon becomes fatiguing; causes a feeling of weakness and distress, and is apt to produce an irritation of the larynx and a chronic cough. The cough in turn increases the irritation, and thus a vicious circle is established which may involve the bronchial tubes and the lungs, and result in serious discomfort and even in dangerous complications.

CHAPTER III.

ANATOMY OF THE TEETH.

THE animal kingdom exhibits a wonderful diversity in the dental structures of its various classes, corresponding to an equal diversity in the uses required of them by the instincts and necessities of the animal. Their conformation indicates so definitely the species in which they are found that they are accepted as one of the best means of classification, showing the distinguishing peculiarities of the animals to which they respectively belong.

The teeth in man are hard, bone-like structures implanted in sockets along the jaws, and are intended to fulfil various useful purposes. Two sets of teeth are developed in the human mouth — the first called the deciduous, temporary, or milk teeth; the second, the permanent set.

A tooth consists of enamel, cementum, dentine, and dental pulp. The exposed part — that above the gum — is called the *crown;* that which is held within the socket, the *root;* and the narrow part between the crown and the root, the *neck.*

The enamel is the cap or covering of the crown. It is the hardest tissue of the body. It is thickest on the cutting edges and masticating surfaces, gradually becoming thinner towards the neck, at which point it is met or slightly overlapped by the cementum. The enamel is possessed of very slight if of any sensibility. It contains not more than four per cent. of animal matter, and is almost entirely soluble in acids. Under the microscope it is found to consist of parallel fibres or rods lying side by side — generally hexagonal, but some nearly circular, and others nearly square. A transverse section of enamel fibres is shown in Fig. V.

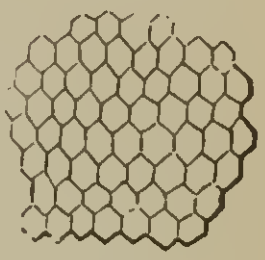


Fig. V.

The cementum is a layer of hard tissue covering the roots of the teeth. It is intermediate in hardness between dentine and bone, resembling the latter more than either of the other hard tissues found in a tooth. It is thickest at the terminus of the root, gradually diminishing until it seems to unite with or slightly overlap the enamel at the neck of the tooth.

The dentine, or so-called ivory, constitutes the bulk of the tooth. It is, so to speak, its framework, giving each tooth its size and shape. If the enamel and cementum were removed, the dentine would still preserve the general form of the tooth. It is commonly but erroneously called tooth-bone. It contains over one-fourth of animal matter, and when subjected to

the action of acids the earthy matter is dissolved out, leaving a cartilage-like mass retaining the form of the tooth. Examined microscopically, it is found to consist of innumerable tubes of a diameter of about $\frac{1}{4500}$ of an inch. It is usually highly sensitive both to variations of temperature and to contact with foreign substances, making the excavation of a cavity in a tooth, preparatory to filling, more or less painful. It is more sensitive just beneath the enamel than in its deeper portions. It owes nearly all its sensitiveness, however, to the pulp of the tooth, and when the pulp dies the dentine loses almost all, if not all, of its sensibility.

The pulp, commonly but incorrectly called the nerve, occupies a cavity in the centre of the tooth and corresponds to its general form. This pulp is the uncalcified portion of the original germ of the tooth. From this the dentine was developed, the pulp being gradually converted into that substance up to a certain point, when the process of calcification or deposit of earthy matter ceased, leaving a cavity occupied by what was left of the pulp. The pulp is a mass composed of nerves and blood-vessels held together by a cobweb-like connective tissue. It is acutely sensitive not only to contact with foreign substances, but to variations of temperature. The pulp supplies nourishment to the tooth. When it dies the tooth loses its translucency, the dentine loses its sensibility and

gradually changes in color. Nerves and blood-vessels enter through the minute opening at the extremity of the root, and pass through the small canal in the root to the pulp cavity. With the exception of this small aperture, the pulp is entirely surrounded by solid den-

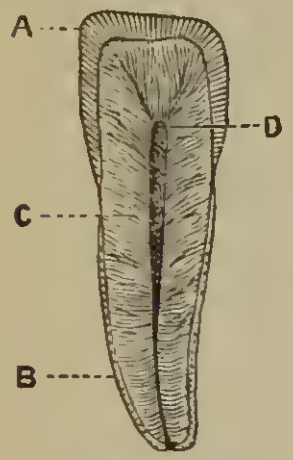


Fig. VI.

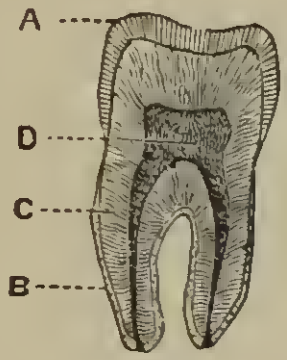


Fig. VII.

Fig. VIII.

tine. Figs. VI. and VII. represent a central incisor and a molar, split vertically so as to show their various parts. A is the cutting edge or grinding surface, covered, as is the entire crown, with enamel; B, the cementum covering the roots; C, the dentine; D, the pulp cavity. Fig. VIII. shows a transverse section of a molar, of natural size, in which 1 is the dentine; 2, the enamel; 3, the pulp cavity.

The teeth do not change in shape or increase in size after they are erupted, though their tissues gradually become denser and harder. The crowns are completed as to size and form before their eruption. The roots, however, are not completed at that time, and, instead of a conical termination with a minute

opening at the end of the root, the aperture is quite large. The enamel, which when fully hardened will strike sparks with steel, is still comparatively soft. It undergoes a gradual process of hardening after the eruption of the tooth; but this is the only change except that of decay — for, although it contains a small proportion of animal matter, and is therefore of necessity nourished, there is not a sufficient nutritive supply for its repair or renewal, and consequently when once destroyed, either by disease or accident, it cannot be restored.

Classification of the Teeth. — The permanent set of teeth consists of thirty-two — sixteen in each jaw. Those in the upper jaw are called the superior; those in the lower, the inferior. They are divided into four classes, viz., incisors, cuspids, bicuspids, and molars. Fig. IX. represents the permanent teeth — superior and inferior — of the left side. The incisors — four in each jaw — are so called from the Latin word *incidĕre* (to cut), on account of their sharp edges. This class is subdivided into central incisors, because of their position in the centre of the arch, and lateral incisors, because they stand on either side of the centrals. The second class comprises four teeth — two in each jaw — called cuspids or *cuspidati* (singular, *cuspidatus*), from the Latin word *cuspis* (a spear), because they terminate in a point. They are commonly known by the name of canines,

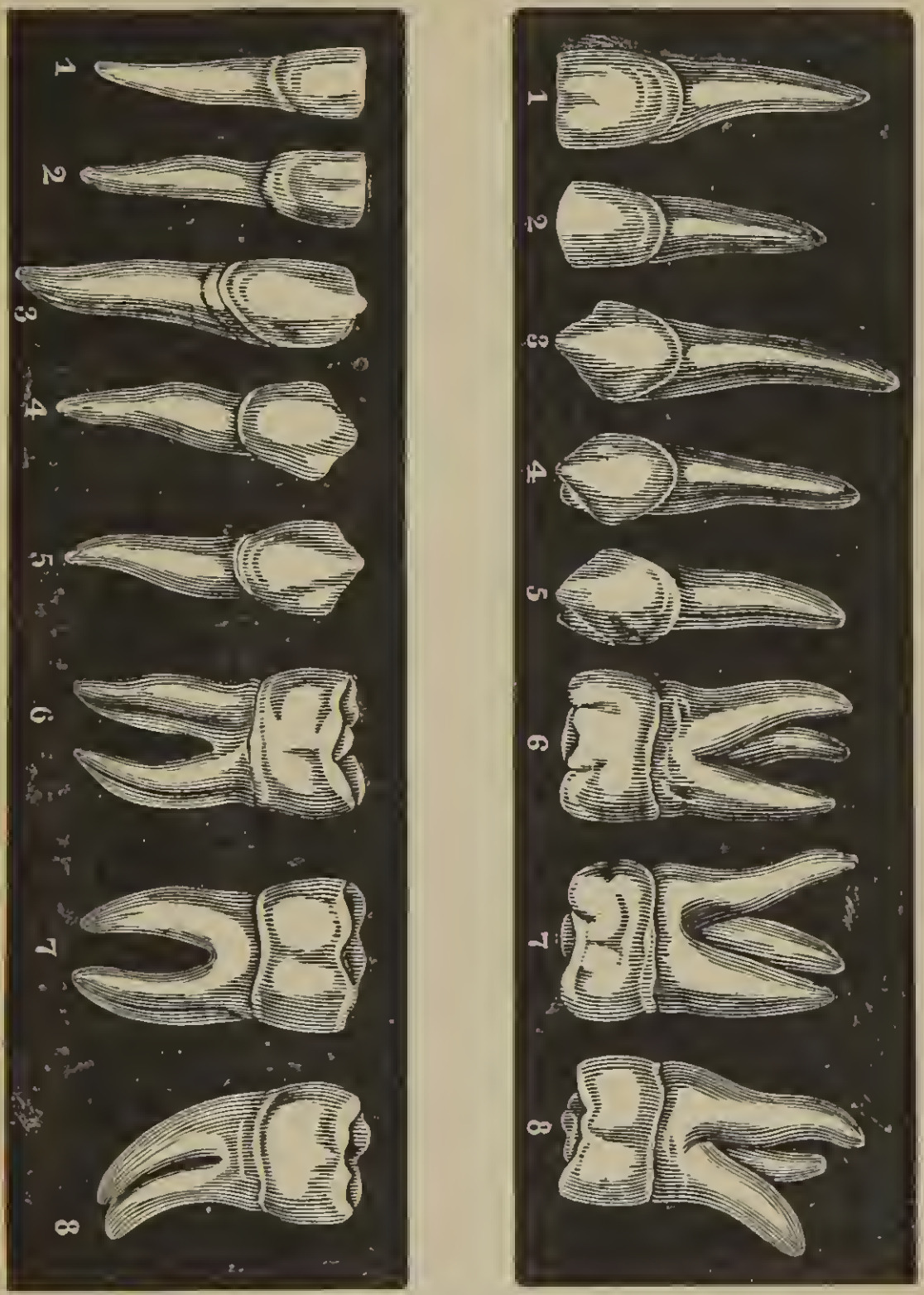


Fig. IX. — Permanent Teeth of the Left Side.

or those of the upper jaw as eye teeth, and those of the lower jaw as stomach teeth. They are situated on the outer side of each lateral incisor. The third class comprises eight teeth — four in each jaw — called bicuspids or *bicuspidati* (singular, *bicuspidatus*), from the Latin words *bis* (twice) and *cuspis* (a spear) — double-pointed. They are sometimes designated as pre-molars or half-molars. They are situated immediately behind the cuspids, holding an intermediate relation to them and the molars, and are known as the first and second bicuspids. The fourth class consists of twelve teeth — six in each jaw. They are called molars — Latin, *molāres* (singular, *molāris*) — from *molĕre* (to grind, as in a mill). They are situated back of the bicuspids, and are known as the first, second, and third molars. The first, because of the time of their eruption, are called the sixth-year molars; the second, for the same reason, are known as the twelfth-year molars; and the third, for a like reason, are denominated the dentes sapientiæ (singular, dens sapientiæ), or wisdom teeth — from the Latin words *dens* (a tooth) and *sapientia* (knowledge or wisdom), the teeth of wisdom — because they are not erupted until the individual has reached maturity.

The incisors are double-wedge shape — widest at the cutting edge, thickest at the neck, slightly concave on the inner and slightly convex on the outer

surface. The superior or upper are larger than the inferior or lower incisors, and the central incisors are wider than the lateral. In the case of the inferior incisors, the laterals are wider than the centrals. The incisors, both superior and inferior, have each but one root. The use of these teeth in eating is to "bite" or cut off a portion of food, operating on the same principle as a pair of scissors. The cuspids are less concave on the inner surface, and more convex on the outer surface than the incisors, and terminate in a point. They have but one root, but this is longer and stronger than that of any other tooth in the mouth. The superior cuspids are larger and have longer roots than the inferior. The use of the cuspids is to seize and tear or lacerate obstinate substances preparatory to mastication. It is an interesting fact that these teeth are more prominent in proportion as the animal approaches the purely carnivorous or flesh-eating class, and are never found in an animal having horns. The bicuspids are smaller than the cuspids, convex on both outer and inner surfaces, and flattened on the sides. Their long diameter is across the jaw. The roots are conical. The inferior have but one root; the superior sometimes a single root, often deeply grooved, and sometimes entirely divided —bifid. The molars have large grinding surfaces, divided by grooves into cusps or points. The crowns of the inferior are larger than those of the superior.

In each jaw they decrease in size from before backward. The superior first and second molars have as a rule three roots each. The inferior first and second molars have each two roots, which are often deeply grooved, and sometimes bifid. The third molars or wisdom teeth of both jaws have but a single root

Fig. X.

each, though this is sometimes divided into three in the upper jaw and two in the lower. The inferior third molar is larger than the superior.

The deciduous or temporary teeth are much smaller than the permanent, although the roots are generally larger and longer in proportion to the size of the

crowns than those of the adult set. There are only twenty teeth in the deciduous set —four incisors, two cuspids, and four molars in each jaw. Fig. X. represents the temporary teeth—superior and inferior—of the left side. There are no bicuspids and no third molars or wisdom teeth in the temporary set. Four bicuspids and two wisdom teeth in each jaw—twelve in all—which are not in the deciduous or temporary set, make the permanent set to consist of thirty-two teeth.

The surfaces of the teeth which are towards the lips are called "labial;" towards the cheeks, "buccal;" towards the tongue on the lower jaw, "lingual," and towards the roof of the mouth on the upper jaw, "palatal." The surfaces next to each other are called "proximate;" those looking towards the centre, "mesial," and those looking from the centre, "distal." The parts of the six front teeth of both jaws which come in contact with each other are called the "cutting edges," and the broad surfaces of the bicuspids and molars which are brought in contact in the act of masticating are called the "grinding or articulating surfaces."

ARRANGEMENT OF THE TEETH.—The teeth in man are arranged in close contact, without intervening spaces, affording each other mutual support after the manner of staves in a barrel. Being set without interspaces on a curved line, it follows that their outer

surfaces are wider than the inner. The upper arch is larger than the lower, and from this fact the incisors and cuspids of the upper jaw, when the mouth is closed, overhang or shut in front of the lower teeth. The upper central incisors are broader than the lower, during occlusion causing the teeth on either side

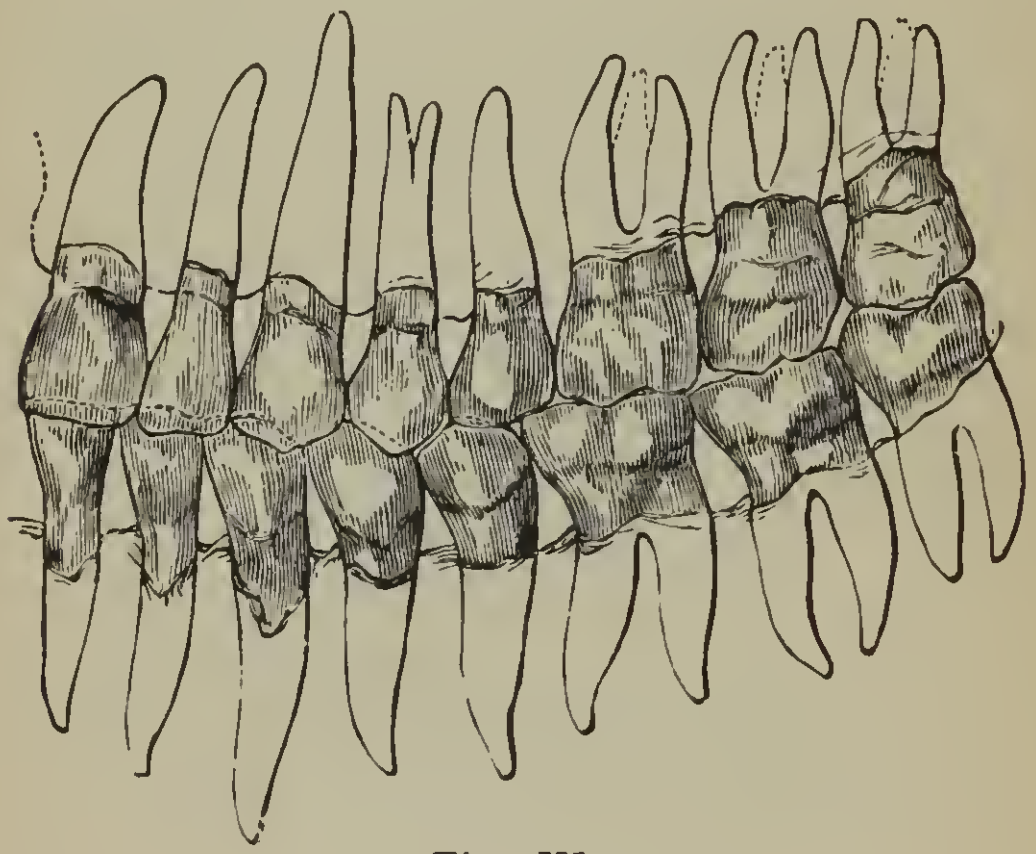


Fig. XI.

of them to be thrown out of exact correspondence with those of the lower jaw occupying the same relative positions, thus bringing about an irregularity of opposition, like that called by bricklayers "breaking joints"—so that each tooth, instead of being antagonized by a single tooth, is met by portions of the

surfaces of two teeth, as illustrated in Fig. XI. Further back in the arch the difference is harmonized by an increase in the size of the molars of the lower jaw beyond that of the upper, which brings the arches out even. This irregularity of opposition of the upper and lower sets is a valuable feature, as when a tooth is lost from the arch in either jaw the opposing tooth is not rendered useless, as it would be if the teeth were in perfect opposition with one another, because it is brought at least partially into contact, during mastication, with the tooth which adjoined the missing one.

In rabbits and other "Rodents" the teeth grow constantly in length, in order to repair the waste due to their use in gnawing. A curious result follows the loss of one of the incisor teeth in these animals. The opposite remaining tooth not being worn away, grows to such a length as to prevent gnawing, and so causes the death of the animal by starvation.

CHAPTER IV.

DEVELOPMENT OF THE TEETH.

THE development of the teeth is one of the most curious and interesting of the processes of growth in the body. At about the seventh week of fetal life, small gelatinous bodies, which are the tooth pulps, are distinguishable in the jaws; and at about the tenth week the germs or developing pulps of all the temporary teeth — twenty in number — are in position. These germs gradually increase in size, assuming the shapes of the teeth which they are to form. Meanwhile, the enamel and the cementum are being formed, each from a separate matrix or mother; the alveolar processes are being built along and across the jaws, dividing the pulp of each tooth from its fellow, and providing a separate socket for each root, so that when matured they will afford firm support to the teeth. At the same time, the different membranes which are to line the sockets and cover the roots of the future teeth, those which are to cover the jawbones, and those to cover the gums externally, are also developing.

When the pulps have attained proper dimensions, representing the forms of the future teeth, they are gradually, by a process known as calcification, partially converted into the dentine, which forms the largest portion of the bulk of each tooth; the enamel which is to protect the crowns and the cementum to cover the roots continuing to be deposited. At birth the forms of the crowns have been fully developed, though the roots are as yet but partially formed; these latter being the result of the elongation of the pulps and the deposit of dentine and cementum. The alveolar processes are gradually built up, and, after they have reached a sufficient height above the crowns of the teeth, their edges approximate so as to partially close them in and form bony cells, within which the further development of the teeth is continued.

During the development of the deciduous or temporary teeth there appears, at about the fourth month of fetal life, a second set of little gelatinous bodies, which are the germs of the second or permanent teeth. Of these, first in order of appearance are those of the first or sixth-year molars (to be erupted when the child is about six years of age); next, those of the central and lateral incisors (to be erupted at about the eighth year of age); then those of the cuspids (canines or eye teeth); then the first and the second half-molars (bicuspids). Thus, at birth we find in the jaws the

twenty deciduous or temporary teeth all in a state of forwardness, and also the germs of twenty-four of the permanent set in various stages of development. The germs of the second or twelfth-year molars do not make their appearance until three months after birth, and those of the third molars (wisdom teeth) not until the child is about three years of age. The process of calcification of the twelfth-year molars does not commence until the child is about three years of age, and that of the wisdom teeth not until about the twelfth year.

CHAPTER V.

ERUPTION OF THE TEMPORARY TEETH.

AT about the fifth month after birth the process known as the eruption of the teeth begins — a double process, consisting of the gradual elongation and rising of the teeth, and the coincident absorption of the hard and soft tissues overlying them. The alveolar borders are the first to show signs of the absorptive process by a dissolution or melting of their approximated edges, thus gradually making a wider space for the advancing teeth. These, rising in their sockets — the roots meanwhile lengthening — press upon the overlying gums, which, becoming thinner and thinner, finally allow the escape of the imprisoned teeth. It is not, therefore, as the common expression of "cutting the teeth" would indicate, a process of laceration, tearing, or cutting, but of removal of impeding tissue by absorption, which allows the passage of the teeth through the gums. There is no *absolute* uniformity either as to the time or the order of eruption. The rule is that the lower teeth precede the upper of the same class two or three months; but

not infrequently the upper precede the lower by the same difference in time. Again, the rule is that the teeth are erupted in pairs, with an interval between the different pairs; but occasionally a single tooth will appear a considerable time before its fellow, and in other cases two or three pairs will erupt coincidently. Fig. XII. illustrates an upper deciduous or temporary set of teeth, of which five are on each side. The usual order of their eruption is as follows: —

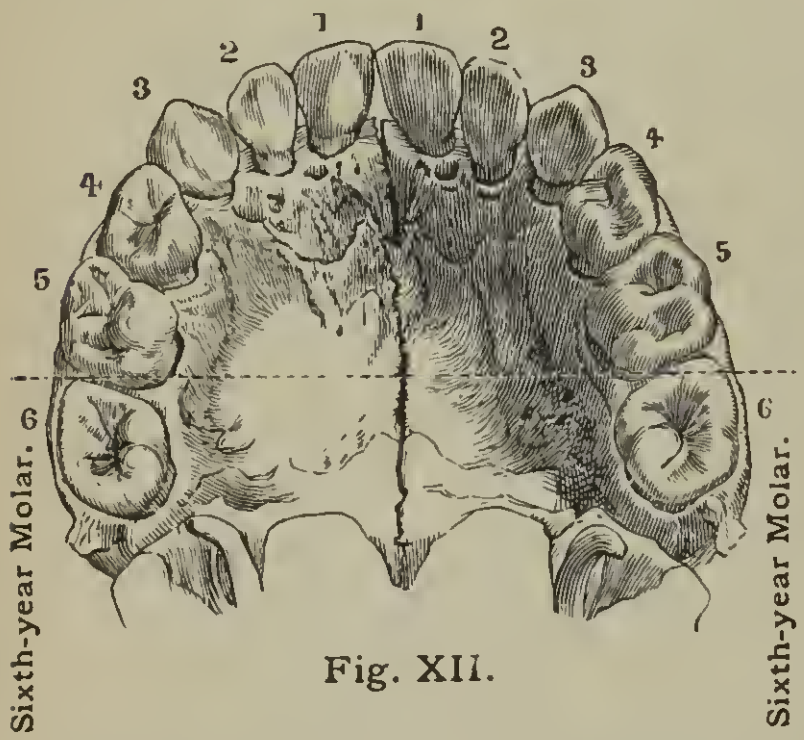


Fig. XII.

2 Central incisors	(Nos. 1)	between	the	5th	and	8th	months.
2 Lateral incisors	(" 2)	"	"	7th	"	10th	"
2 Canines	(" 3)	"	"	12th	"	16th	"
2 First molars	(" 4)	"	"	14th	"	20th	"
2 Second molars	(" 5)	"	"	20th	"	36th	"

The lower set consists of the same number of teeth, known by the same names. They appear, as a rule, in the same order as the upper teeth, generally pre-

ceding the latter by a few weeks. Fig. XIII. is a side view of a child's lower jaw. *The teeth in Figs. XII.*

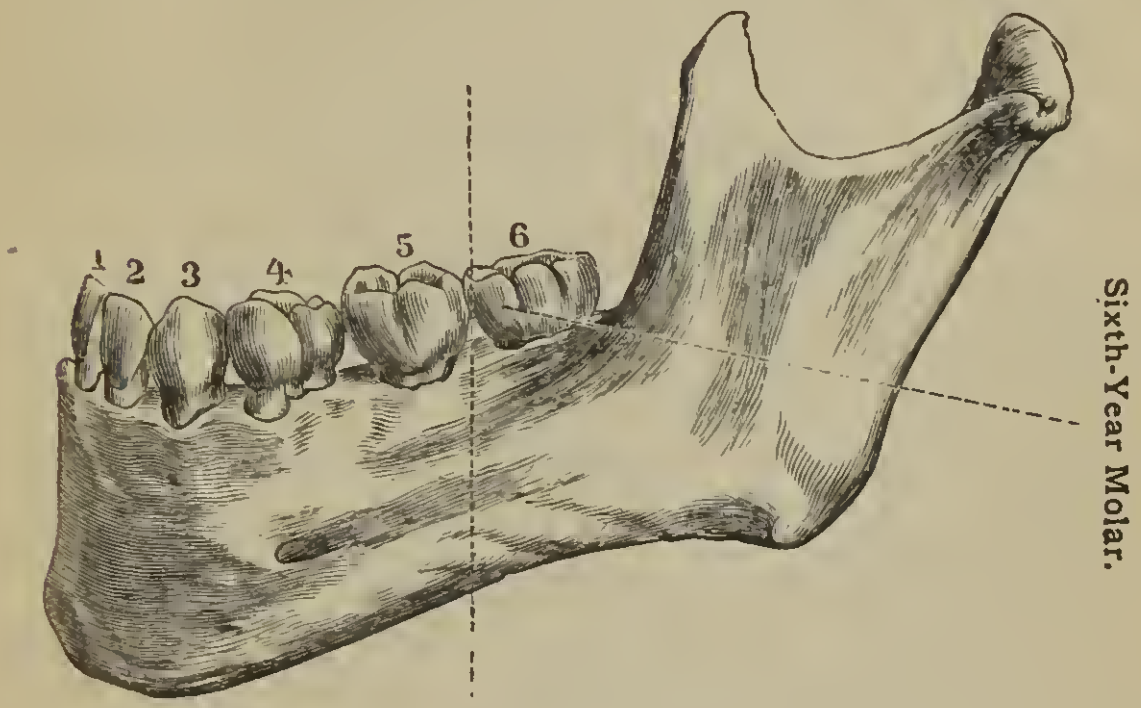


Fig. XIII.

and XIII. marked 6 *do not belong to the temporary set.* They will be treated of in a separate chapter — "The Sixth-Year Molars."

CHAPTER VI.

DIFFICULT DENTITION.

THE eruption of the teeth is a natural process which, under conditions in every way favorable, may take place with little or no disturbance or discomfort to the child. When the growth of the teeth and absorption of the gums proceed in perfect accord, the teeth may be erupted without attracting the attention of even a watchful mother. But comparatively few such instances occur. It is rare for a child to pass through the period of dentition without more or less manifestation of suffering, and frequently there are serious and alarming disturbances of its health. It is a well-known fact that this is the period of greatest mortality among children. It is true that during the same period other and important changes are taking place in the organization of the child, especially in the stomach and intestinal tract, which are intended to prepare them to receive and digest solid food — changes which may be said to be concordant with the development of the masticatory apparatus. Doubtless these concurrent changes exercise their full share

in producing constitutional disturbances at this epoch. This, however, makes it only more imperative that the child shall have even more than usual hygienic care and freedom from all avoidable disturbing influences; for whatever tends, by modifying the general health unfavorably, to lower the resisting power of the organism, may readily convert the natural and otherwise easy course of dentition into one of pain and danger.

There is certainly during the period of dentition an increased susceptibility to nervous and digestive troubles, requiring more than ordinary watchfulness of the child on the part of the mother. Causes which at other times have no appreciable effect may then be fraught with danger. An exposure to cold, an attack of indigestion — anything which introduces inharmony into the functions of the animal life — may result in a disturbance of the processes of dentition.

Difficult dentition may therefore be charged with causing or aggravating various disorders, as these on the other hand may be reasonably suspected of interfering with the natural eruption of the teeth. It is certainly unsafe to ignore the complications possibly due to dentition, if any derangement of the health of the child occur during the period when the teeth are erupting.

As a rule the amount of irritation holds a relation to the number of teeth advancing simultaneously; but,

owing to the varying susceptibility of individuals, a single tooth may cause more disturbance in one case than a half dozen will in another.

At the commencement of the eruption of the teeth there is generally an increased flow of saliva, which keeps the mouth moist and cool. When the irritation increases, and the mouth becomes hot and dry, other derangements are likely to follow: the child becomes feverish; constipation or diarrhea ensues — the latter, if not too severe or too protracted, being beneficial, however, rather than hurtful, but requiring nevertheless great care that it does not itself become a source of danger. An unusual redness of one or both cheeks, sometimes changing from one to the other, is a frequent symptom of nervous disturbance. Eruptions are apt to appear, usually on the cheeks, but sometimes on the head, or even over the whole body, and ulcerations on the tongue, gums, lips, or on the inside of the cheeks. Itching of the nose, twitching of the muscles, dilatation of the pupils, uneasiness and fretfulness, restless sleep or wakefulness, thirst and loss of appetite, are evidences of increasing irritation, which, if not relieved, will be followed by more active manifestations. The child becomes cross, resentful, moans when asleep, cries persistently when awake, or, if quiet for an instant, will be found chewing its thumb or fingers, which operation seems to afford a momentary cessation of

anguish — but only momentary. It throws down its toys as though in a passion, refuses to be amused, and treats all effort to divert it as an indignity; compresses its lips, corrugates its brow, shows an intolerance of light, pulls at its hair or ears, slaps or scratches its nurse, refuses its food, or vomits it as soon as swallowed. Further manifestations of increased constitutional disturbance are likely to appear in persistent and copious diarrhea, nausea, high fever, and not infrequently convulsions.

There is reason to believe that earache is often associated with and dependent upon the difficult eruption of one or more teeth, and that, apart from the aggravation of the fever and the increased liability to convulsions incident to this added anguish, there is also the possibility of the loss of hearing (entailing in young children the loss of speech), from the congestion and inflammation which result. But this is not the only, indeed not the chief, danger; the inflammation is liable to extend to the membranes of the brain and end in death. The facility with which an irritation originating in the mouth may be continued to the ear, and thence to the brain, can only be understood by a recognition of the intimate relations which exist — especially in the infant — between the parts concerned, and of their elaborate nervous connections; but the danger is a real one, and should

never be lost sight of in the treatment of a child suffering from teething.

The usual indications in the mouth of the advancement of the teeth are increased heat, redness, swelling and hardness of the gum, and later the peculiar whiteness caused by the pressure of the coming tooth. Sometimes the swelling takes the form of a little tumor, like a boil, on the edge of the gum; in other cases an ulceration will form over the presenting tooth. In all such conditions the gums are very tender, so sensitive that the lightest touch will cause pain, and the child, on attempting to take the breast, will jerk back its head — a maneuver which is frequently mistaken as an evidence of colic. A little watchfulness on the part of the nurse will enable her to distinguish the difference between the indications of the two troubles.

Sometimes, however, the irritation of dentition may produce the most serious constitutional derangements without any *local* manifestations. That such may be the case is apparent when the conditions of the parts concerned are understood. The troubles of dentition are caused to some extent, doubtless, by the direct pressure of the advancing teeth, and the consequent irritation of the nerves of the gums; but this is not the only, nor, it is believed, the principal factor in the disturbance. It must be borne in mind that at the time of eruption the roots of the teeth are not

yet complete; that, instead of the conical termination and minute opening which characterize the root of the perfected tooth, the aperture is quite large, and its edges thin and sharp. In estimating, therefore, the mischief which may result because of a lack of accordance between the eruption of a tooth and the absorption of the tissues which impede it, we may imagine the sensitive nerve — which, when exposed by decay, is so intolerant of contact even with the atmospheric air — held between the bony socket and the sharp edge of the incomplete root by the backward pressure of the resisting gums, thus giving rise to a true toothache, comparable only to that exquisite torture which is experienced in after-life from an exposed and irritated pulp. It is not difficult to comprehend that a free division of the gum over the tooth or teeth thus situated may, by removal of the pressure, give immediate and complete relief. This simple operation of dividing the gum over the teeth which are next in the order of eruption is surely justified by local manifestations such as have been specified; it is also suggested by the occurrence of the usual symptoms of difficult dentition, even when there does not exist a single local indication in the mouth. Under such circumstances it would seem proper to give the child the benefit of the doubt by free incisions over the teeth whose eruption is, in accordance with general expe-

rience, to be anticipated — especially as the operation causes only a trifling amount of pain, inflicts no injury, and is practically free from danger.

The objections which are generally made against lancing may be summed up as follows: That it is unnecessary because of the comparative insensibility of the gum tissue, and because the progression by growth of a tooth is inadequate to make pressure sufficient to cause serious discomfort; that it inflicts pain upon the child; that it is liable to injure the developing tooth; that there is danger of serious hemorrhage following; that there is an increased resistance to the eruption of the tooth by the cicatrix or scar which results, and that a repetition of the operation is often necessary.

The first objection named finds answer in the immediate, manifest, and complete relief to the infant which so often follows the operation that the relation of cause and effect is apparent to every observer; finds answer, also, in the testimony of every adult who has experienced the comfort resulting from the employment of the lancet in the case of difficult eruption of a wisdom tooth. That the amount of pain inflicted is of the most trifling character, may be inferred from the readiness with which a child, old enough to appreciate conditions, submits to the operation after it has once realized its benefits. Only an ignorance of the anatomy of the mouth entirely

inexcusable in any dentist or physician could lead to the infliction of permanent injury. The liability to serious bleeding from such use of the lancet is so small that it is not worth considering as a danger in comparison with the vastly greater risk incurred by its non-employment when indicated. The assumed increased resistance of the cicatricial or scar tissue is as unfounded as it is common. Even though the wound made by the lancet should heal completely before the eruption of the tooth, the scar tissue is *less* instead of more resistant than the original structure, and is easier of absorption. This fact is illustrated by the readiness with which a "cracked lip" in winter cracks again in the same place, although seeming to have been perfectly healed. That a more or less frequent repetition of lancing for the relief of the same tooth is sometimes necessary, is because of a persistence of the conditions which required the first incision.

The reasons for the methods of lancing which are considered to promise the best results are easy of comprehension. Premising that the object of lancing is not merely nor chiefly to induce a flow of blood, but to remove tension, it follows that the cuts should extend through the gum to the presenting surface, and should be made with special reference to the form of the coming tooth. The incisors need only a division of the gum in the line of the arch. The molars

require a crucial incision, as shown in Fig. XIV. In the case of either of the incisors, superior or inferior, owing to their straight edges, the slightest appearance of the tooth through the gum gives entire relief so far as that particular tooth is concerned. Not so, however, with the cuspids and molars. The cuspids, it will be remembered, have cone-shaped crowns, and therefore, even after the eruption of the points, still keep up the pressure by reason of the inclosing ring of gum, as shown in Fig. XV. A complete severance of this ring on the lateral surfaces, as well as on the anterior and posterior faces, as shown in Fig. XVI., is necessary to relieve the tension. So, all the cusps or points of a molar tooth may have erupted, and yet bands of gum tissue around and between them, as shown in Fig. XVII., maintain a resistance as decided as before their appearance, but which is entirely overcome by cuts as shown in Fig. XVIII. If, after lancing, the cuts should heal before the tooth is fairly through the gum, the operation

Fig. XIV.

Fig. XV.

Fig. XVI.

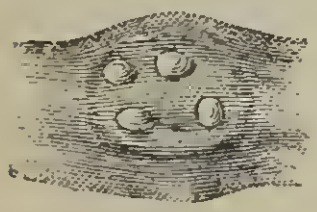


Fig. XVII.

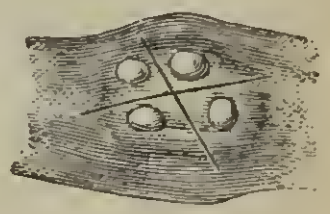


Fig. XVIII.

should be repeated as often as is necessary. Sometimes, but not often, there is a little too much bleeding, generally caused by the child sucking the gums, incited thereto by the taste of the blood. In such case the substitution of the breast of the nurse will give the infant better employment. The extent of the bleeding can be ascertained by touching the wound occasionally with a napkin-covered finger, and when it continues longer than seems desirable, a little very finely-powdered alum, rubbed into the incisions, almost certainly controls it. If this fails, and the case should require the attention of the physician or dentist, the trouble is still quite amenable to treatment.

CHAPTER VII.

CARE OF THE TEMPORARY TEETH.

THERE is a marked structural difference, consistent with the length of service required, between the temporary and the permanent teeth — a modification in the proportions of their constituents. The temporary teeth contain a much larger amount of animal matter than the permanent; are consequently of a less dense texture, and therefore more liable to rapid decay. The pulps of the deciduous teeth are relatively larger than those of the permanent set, and when nearly or quite exposed by decay are more susceptible to the action of irritating agents, and are more likely to lose their vitality under untoward influences. For these reasons they need even more care and attention than the permanent teeth. The temporary teeth are intended to perform important offices, and their retention in the mouth in a healthy condition until their successors are ready to appear is very desirable. Besides their value in the mastication of food, they probably assist in the development of the jaws; certainly their too early loss may result

in an irregular condition of the second or permanent set, producing a disfiguration of the mouth and interfering with the comeliness of the face throughout life. The premature extraction of the temporary molars is fraught with danger to the bicuspids. These latter, as will be seen by reference to Fig. XIX. (see p. 69), are located, during development, in the crotches of the roots of the former, the extraction of which may inflict permanent injury upon them.

It is a mistake to suppose that the temporary teeth may be extracted at any time without injury. The domestic dentistry which watches for the first evidence of their loosening in order that they may be promptly removed, is generally a mischievous interference. Another mistaken notion is that the temporary teeth were intended to be lost by decay, and in this manner to make room for their successors. Under favorable conditions they ought not to decay at all, but after they have fulfilled their mission they should drop out as white and clean as when they first appeared. If allowed to decay, their pulps become exposed, giving rise to pain, leading generally to extraction of the teeth; or, if the pulps die because of the exposure, gum-boils form and interfere with mastication. Moreover, when the pulp of a temporary tooth dies, absorption of the roots is arrested, and the tooth remains to cause soreness, inflammation, and suppura-

tion — sometimes to be a mechanical obstacle to the advance of the succeeding tooth, which, as a result, may assume a position inside or outside instead of in the line of the arch. Though the premature loss of the temporary teeth is, as a rule, to be deplored, there are cases in which the extraction of one or more of them at the opportune time will save much trouble in securing a regular alignment of the permanent set.

The exemption of children from the suffering caused by dental decay, and the immunity of the parent from the consequent inconvenience, will be best secured by constant attention to the teeth from their first appearance. The general health of the child will also be promoted by keeping them in such a condition that mastication can be performed without pain; otherwise the child will soon learn to avoid that which is troublesome or painful, and, by swallowing its food without proper mastication, will bring upon itself all the evils of indigestion. In infancy the mother should make it a part of her daily care of the child to secure perfect cleanliness of its teeth. Becoming thus accustomed to it, the child when old enough to rinse the mouth properly or to use the brush will find it impossible to feel comfortable after a meal until the teeth have been cleansed; the habit thus early formed is almost sure to be continued through life. Small, soft tooth-brushes and pleasant dentifrices are now manufactured exactly suited for children's use. In cases

where, in spite of all the care given them, the temporary teeth show symptoms of decay, equal or even greater care than would be given to the permanent teeth under similar conditions should be taken to prevent its extension, and cavities of decay, particularly in the molars, should be filled with some one of the various preparations now in the hands of the dental profession. A good rule is to have a dentist examine the mouth of the child, after it is two and a half years old, at least twice a year, or oftener if necessary.

CHAPTER VIII.

SIXTH-YEAR MOLARS.

IT must not be forgotten that the eruption of the second set begins before any of the first teeth are shed. Thus, between five and a half and six and a half years of age the first permanent molars, four in number — one on each side of the upper and lower jaws — make their appearance. These are commonly supposed by parents to belong to the first set, and therefore, if found decayed shortly after their eruption, no attention is paid to them, because it is thought that they will soon have to make room for their successors, and before the error is discovered the mischief is irreparable. Although, as already stated, the crowns of the teeth are fully formed before their eruption through the gum, the structures of the tooth have not then attained the compactness and hardness which subsequently characterize them, and do not acquire their maximum density for months, or even years. Consequently decay makes greater ravages in a given time in youth than at any subsequent period, except probably during sickness. There is, for reasons

not perhaps fully understood, a great liability in the sixth-year molars to deep fissures with imperfect union of the enamel edges, and from this and other causes a special tendency to caries, so that these teeth are quite frequently decayed before they are fully erupted. This fact shows the importance of extra care and more prompt attention to them; for, if they can be preserved until they become thoroughly solidified, their liability to decay is very much lessened, and the chances of retaining them throughout life are correspondingly increased. The sixth-year molars are the largest teeth in the mouth. In Figs. XII. and XIII. (pp. 48, 49) they are shown in their relation to the temporary set — in a child of about six years of age. In Figs. XX. and XXI. (pp. 71, 72), these same teeth are illustrated in their relation to the permanent set. They are very important teeth in many respects, and should never be allowed to suffer from decay if by any possibility it can be avoided. Even if they cannot be permanently saved, there are good reasons, with reference to the preservation of the integrity of the arch, why they should be retained up to a certain period, viz., to that between the tenth and twelfth years — the time when the twelfth-year molars are about to appear; there are equally good reasons why, if they cannot be retained with a fair prospect of their permanent preservation, they should be extracted at that particular time. Another fact which should

make each one of these teeth the object of special anxiety on the part of the parent is that, in the opinion of many practitioners of ripe experience, the loss of one frequently necessitates the removal of all four, in order to preserve the harmonies of articulation. It has been stated in a previous chapter that the teeth give each other mutual support, after the manner of staves in a barrel, and that the teeth of the two jaws are so adapted to each other that the elevations and depressions upon their surfaces articulate so as to produce the most effective results in mastication. After the extraction of a tooth the adjoining teeth generally change their positions more or less, and the natural occlusion is thereby interfered with, and to a greater or less extent impaired. But, unless the tooth is removed at the proper time, this is the least of the evils likely to ensue. If too early, the adjacent teeth close up, causing irregularity when the other teeth erupt; if a little too late, the space is never perfectly closed, and the teeth on either side, lacking their natural support, lean towards the vacant space — tipping over, so that the occlusion in mastication is constantly forcing them further out of position. As a result the gums recede on the sides next to the vacancy, the alveolar processes are absorbed, the unsupported teeth become tender, painful, and loose, and are consequently lost; those next adjoining are similarly affected and lost in turn; and so, as a consequence of the extrac-

tion of a sixth-year molar after the eruption of the bicuspids and the twelfth-year molar, the side of the mouth from which it was taken is ruined before middle life is reached; and, if the same condition exists on the other side, the function of mastication is practically destroyed. Are not these sufficient reasons why parents should feel the necessity for constant supervision of the sixth-year molars?

It is a good rule for parents to count their children's teeth occasionally after the fifth year, and, when more than five are found on either side of either jaw, they may know that the sixth or last one belongs to the second or permanent set, and if lost will never be replaced; that if extracted except at the exact time when the conditions are most favorable, the results may be disastrous to the entire denture, more or less interfering with comfort and health, and, by the consequent prevention of perfect mastication, leading to dyspeptic and intestinal derangements tending to shorten life. The want of a proper appreciation and proper treatment of these sixth-year molars is, it is safe to say, one of the most fruitful causes of the defective masticatory apparatus of a vast majority of people at and beyond forty years of age.

CHAPTER IX.

SHEDDING OF THE TEMPORARY AND ERUPTION OF THE PERMANENT TEETH.

WHEN the small size and delicate structure of the jaws of an infant, and the fact that the teeth correspond to them in size, are considered, it will be apparent that the provision of a second set, large and strong in proportion to the increased size and strength of the adult jaw, is a necessity. Almost coincidently, therefore, with the development of the germ of each temporary tooth, and in what may be termed an appendage to the sac in which it is inclosed, appears the germ of its successor. The germ of the first permanent (sixth-year) molar is formed independently, like those of the temporary teeth, but gives off an appendage in which is formed the second or twelfth-year molar, which in turn supplies an appendage for the production of the third molar or wisdom tooth. While, therefore, the development of the temporary teeth is advancing, the germs of the second or permanent set are also progressing. When the former erupt, the latter are in various stages of development.

Fig. XIX. illustrates the jaws of a child about six years of age, in which the relations of the two sets of teeth are shown — the temporary teeth still in position, and the sixth-year molars just erupting. The permanent incisors, both upper and lower — which after the

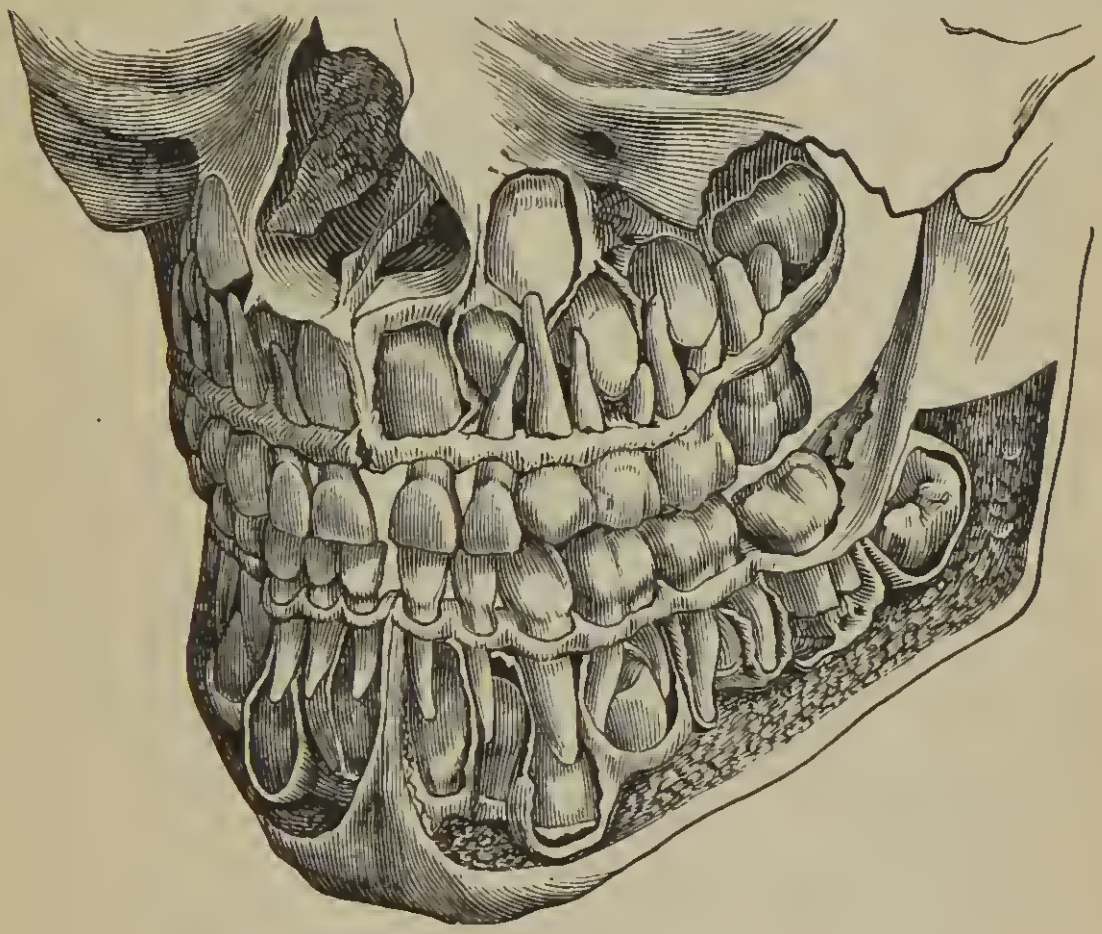


Fig. XIX.

sixth-year molars are the next to erupt — are the most advanced, both as to completeness of form and as to position. The canines, which are not due until the child is between eleven and thirteen years of age, are not nearly so complete in form, nor so far advanced towards eruption.

As the permanent teeth approach their full development, a process called "absorption" is set up, by which the roots of the temporary set are gradually removed. Little by little the roots are dissolved, and the particles composing them are carried away, until only the crowns remain. This absorptive process does not begin upon the roots of all the temporary teeth at once, but in the order corresponding to their development and eruption. The lower central incisors are the first to become loose and fall out; then the upper central incisors; then the laterals, and so on in the order in which they appeared. Deprived of their support in the sockets, and retaining only a slight attachment to the gums, the crowns are pushed out by the movements of the tongue, cheeks, or lips during mastication, or are picked out with the fingers.

The second or permanent teeth are thirty-two in number, including twelve not found in the temporary set, viz., eight bicuspids and four wisdom teeth — the sixth-year molars constituting a part of this set. The following table gives the average time and order of eruption of the permanent teeth, liable, however, both as to time and order, to very considerable variation in exceptional cases: —

First molars, . . .	5 to 6 years.
Central incisors, . . .	6 " 8 "
Lateral " . . .	7 " 9 "
First bicuspids, . . .	9 " 10 "

Second bicuspids, . . .	10 to 11 years.
Canines, . . .	11 " 13 "
Second molars, . . .	12 " 14 "
Wisdom teeth, . . .	17 " 21 "

Fig. XX. illustrates an upper permanent or adult set of teeth, in which Nos. 1 are the central incisors;

Fig. XX.

Nos. 2, the lateral incisors; Nos. 3, the canines; Nos. 4, the first bicuspids; Nos. 5, the second bicuspids; Nos. 6, the first (sixth-year) molars; Nos. 7, the second (twelfth-year) molars; and Nos. 8, the third molars, or wisdom teeth.

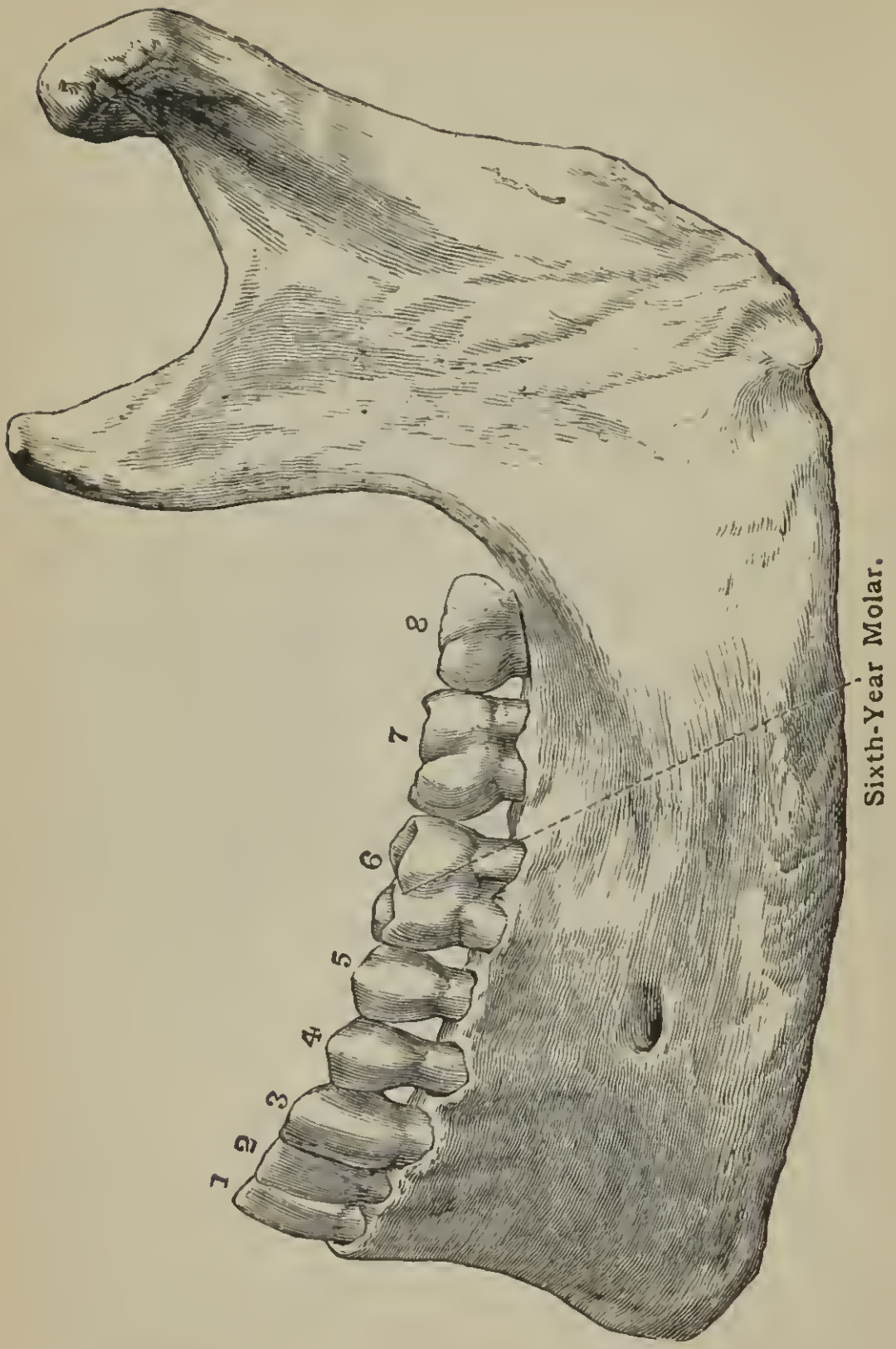


Fig. XXI. — Side View of an Adult Lower Jaw.

Fig. XXI. is a side view of the adult lower jaw. The lower teeth are known by the same names as the corresponding teeth of the upper jaw.

The cutting edges of the incisor teeth are, when first erupted, divided into little cusps or points (probably intended to facilitate their eruption), giving them a saw-like appearance. These points, after the teeth have been put into active service, are soon worn down, leaving smooth and straight edges.

The period included between the sixth and the twelfth or fourteenth year of the child's life is an exceptionally important one with reference to the care of the teeth; their subsequent condition for life depending largely upon their treatment during this period — whether they shall be useful, comfortable, and ornamental, or the reverse. Suitable attention given to the condition of the mouth during this period will, as a rule, in a great measure prevent the necessity of treatment in after life. This attention on the part of the parent or guardian should consist not only in advising or directing the habitual, thorough cleansing of the teeth by the child, but should include a personal supervision of the operation, in order that serious omissions as to time or manner may not occur. In addition, a systematic examination of the mouth by a competent dentist should be made at frequent intervals. It will not do to wait until the child makes complaint of toothache, or until the

ravages of decay make themselves visible to the unprofessional eye. Long before this mischief — irremediable mischief — may have been done.

There is usually but little trouble attending the second dentition; but occasionally there are considerable pain and swelling, and sometimes sore throat, difficulty in swallowing, earache, and even severe constitutional disturbance. Various distressing and obscure nervous affections have been found to depend upon the eruption of a sixth- or twelfth-year molar. The third molars or wisdom teeth of the upper jaw are generally erupted without special trouble, except that which is the result of their contact, by misdirection, with the cheek, causing ulceration. The eruption of the wisdom teeth of the lower jaw generally causes considerable inconvenience and suffering, owing to their being crowded between the second molar and the ramus (the upright portion) of the jaw. The space being insufficient, the gum is pressed between the distal (rear) surface of the tooth and the ramus; the irritation produces swelling, and this is aggravated by the bruising of the gum — in mastication or by the teeth of the upper jaw. Inflammation is thus set up, which extends to the soft tissues of the adjoining parts, making the act of swallowing difficult and painful, and mastication impossible. Sometimes the inflammation results in suppuration, the pus finding exit at points more or less remote,

internal or external. The trouble in such cases is generally of short duration, and ceases upon the complete eruption of the tooth. Other cases require lancing of the gum, or the removal of the overlying portion of gum ; sometimes the extraction of the tooth or of the one in front of it. No general rule for the treatment of these cases can be given. It will depend upon the space in the jaw and the eruption of the tooth in a natural or unnatural position ; if the latter, upon the form of the deviation. The nervous susceptibility and constitutional condition of the individual must also be taken into account. The record of troubles caused by the eruption of a wisdom tooth into a crowded arch shows cases of ulceration and sloughing of the adjacent tissues, disordered vision, earache, deafness, headache, neuralgia, hysteria, St. Vitus's dance, epilepsy, lockjaw, and various other serious disorders — some exceptionally severe cases ending in death.

At six, at twelve, and at seventeen years of age, or until the wisdom teeth have been fully erupted, it is well for patients suffering from eye or ear troubles, or from any deranged condition not otherwise accounted for, to seek the opinion of a competent dentist, in order to learn whether or not an explanation is to be found in the mouth.

CHAPTER X.

THE NUTRITION OF THE TEETH.

NUTRITION is the process by which the various tissues of the body are nourished. The source of nutrition is the blood, essential to the life of every portion of the body, in order that it may obtain the materials required for development, and subsequently for maintenance. The teeth are no exception to this rule, depending for their vitality upon the blood. One of the large vessels which supplies the external parts of the head gives off branches which are called the dental arteries. From these smaller branches are given off, which pass through openings at the bottom of the sockets, and then through the hair-like aperture (the foramen) at the extremity of each root; through the canals of the roots, and into the cavity in the centre of each tooth.

But all use implies wear or waste, and wherever an *artery* carries new material for the building or repair of any tissue, it is accompanied by a *vein* to bear away the waste products, and thus from birth to death every portion of the body is continually undergoing change — waste and renewal. The pulp of a tooth is com-

posed of nerves and blood-vessels; from the nerves pass out on every side minute fibrils which penetrate the dentine; from the blood nutriment is supplied to every portion of the tooth, maintaining its vitality. In addition to this provision for sustaining the life of the tooth, the root is covered by a membrane (the pericementum), from which nerves and blood-vessels pass into the cementum. Thus, after the dentine and enamel (which, as has been previously stated, are dependent upon the pulp for their nutrition) die in consequence of the death of the pulp, the tooth still retains a semi-vitality by means of its root-membrane, and may remain in the mouth without discomfort, sometimes for many years. Although the death of the pulp involves the loss of vitality to so large a portion of the tooth, and should therefore be guarded against with all possible care; yet it should be known that even then, even after the crown is lost through decay, the root is still valuable, and may serve as a base for an artificial crown, or may at least assist in maintaining the adjoining teeth in position and preventing the absorption of their alveolar processes. Even a tooth that has been dislodged by accident or purposely extracted may be successfully replanted in its socket, and, being held in position by ligatures or other mechanical device for a few days, will become firm by virtue of the re-attachment of the pericementum and the re-establishment of a vital relation therewith.

CHAPTER XI.

FOOD IN ITS RELATIONS TO THE TEETH.

THE blood, which as has been said is the source of nutrition to every part of the body, would speedily become impoverished if the materials which it distributes to all the various tissues were not re-supplied to it. The elements required for the development, repair, and maintenance of the muscular, nervous, and bony systems do not originate in the blood, but must be furnished from without. These elements are derived from the food. There is no permanent source of strength but in food. All food, however, is not alike nutritious, and the different parts of the body require different materials for their formation and sustenance. Each organ and each tissue selects from the blood that which is akin to its own structure — like appropriating like. The bones and the teeth require certain earthy matters. These abound in some varieties of food, but are deficient or absent in other varieties. If, therefore, the quality of the blood, which distributes the elements of nutrition, depends primarily upon the food, it follows that if food defec-

tive in quality or deficient in quantity be supplied to the mother during gestation, the child will have an imperfect organization of the teeth. So, if the food of the *nursing* mother be wanting in the materials of which the teeth are formed, there must result a deficiency in the child's dental organs, just as, when the food of the child at a later period is lacking in the bone-producing elements, the later erupted teeth will be defective. In a word, if the food of the mother before the birth of the child, or during the period when it depends upon her for its supply, does not contain the elements to meet the demands, healthy tissues will not be formed. It is believed that in those cases where child-bearing and nursing women fail to supply themselves with food containing the earthy elements, which are then especially needed, there is a drain upon their own organizations by which the child is, to some extent, at least, provided for at their expense. Their own teeth show the effects of the starvation by an increased sensitiveness and rapid decay. A popular apprehension of this fact has crystallized into the proverb, "For every child a tooth." During pregnancy and while nursing, more than usual attention should be given to the teeth, whose increased tendency to decay should be combated by unremitting effort and watchfulness, in order that the future comfort and health of the mother

may not be endangered or her personal attractions be lessened by the loss of teeth.

But the advantages of proper food — that is, of food containing the earthy materials of which the teeth are constructed — are not confined to the developmental period. While such food is of special value in furnishing the necessary constituents for building solid structures during the time when the teeth are developing, it is also required to sustain them in a healthy condition through life. Well-organized teeth are composed mainly of mineral substances, and there is no power in the human organism to create them out of materials which do not contain them. It is, therefore, evident that if these elements are lacking in the materials furnished as food, the teeth, which in large part should be composed of them, must suffer by reason of the deficiency; for observation shows that upon the greater or less amount of their mineral constituents largely depends the ability of the teeth to resist destructive agencies.

For infants there is no other food equal to that supplied by the breast of the healthy mother, and for young children no other food so well suited to the digestive organs, and so capable of supplying all the materials for the growth of the various tissues of the body, as milk. Up to the age of fourteen or sixteen years a liberal use of milk is desirable.

An abundance of the necessary mineral constituents

is found in certain grains, or rather in certain parts of these grains. Whole wheat probably contains more of the essential elements of food than any other grain. Next in value is oats. But it is chiefly the outer portions of the grain which contain the bone-forming material, and these are generally discarded in the manufacture of flour so as to produce a whiter article. That which is discarded is full of nutriment for the bones and teeth; that which is retained is little more nutritious than starch. It is apparent, therefore, that the liability of the teeth to decay depends largely, first, upon their original organization, and that the character of the organization depends upon the supply by the mother or nurse of the mineral constituents which ought to enter into their composition; second, upon the regular supply — especially in early life — of food containing these constituents. The use of oatmeal, of wheaten grits, or of bread made from unbolted flour, as a part of the daily diet from childhood up to middle life, would go very far towards preventing dental caries. Alimentary substances, according to their character, furnish fat, produce heat, or supply muscle, brain, nerve, bone, and tooth material. It is evident that food which does not contain the required elements will not sustain the body in a healthy state. With the single exception of milk, no one article of food supplies all the various requisites. Milk should

form the *exclusive* diet of the child until at least nine months of age, and the principal diet for the first three years of life. Arrow-root, corn-starch, and other farinaceous foods, are *positively injurious* to a child under three months of age. The secretion of saliva before that period is scant, and is, moreover, deficient in a peculiar fermentative property which is essential to produce the change required upon starchy foods to fit them for digestion. This fermentative power is not fully developed in the saliva until the child is about a year old. Starchy foods should not, even at a later period, be made a *staple*, because, though they may create fat, they do not contain the elements of which muscle, bone, and tooth-structure are built. After the child is nine months of age, if weaned, milk should still be made the staple; but the diet may be varied by the addition of oatmeal (boiled to a jelly), wheaten grits, barley flour, rice, farina, sago, bread-crumbs, the yolk of egg with milk, chicken or mutton broth. After one year of age, bread and butter, baked potatoes, and ripe fruits may be gradually added. While on the one hand confinement to any one article of food (unless it be pure, rich milk) should be avoided, and a *varied* diet allowed, care should be taken, on the other hand, to exclude those substances which contain but little nutriment or are difficult of digestion, such as pastry, confectionery (unless of the

simplest forms), cabbage, turnips, the skins or rinds of fruit, etc. The course which is calculated to best subserve the general interests of the child is that which is also calculated to produce the best results in the dental structures.

It may be remarked that any food, however well adapted to the development, nourishment, and repair of the various parts of the animal organism, can contribute to these results only in proportion to its transformation through vital processes. It is therefore necessary not only that a varied and intelligently selected diet be supplied, but that the system be kept in condition to appropriate the materials furnished for its sustenance. Nutrition comprehends digestion, absorption, respiration, circulation, and *assimilation,* and is that change in nutritive matters by which they assume the characteristics of the different living tissues of the body. How much to eat, and what and when, in order that "good digestion wait on appetite and health on both," are therefore topics worthy of careful study.

CHAPTER XII.

NERVOUS RELATIONS OF THE TEETH.

THE cause of so-called *reflex* (reflected) troubles and the circle of *sympathies* between the mouth and other portions of the animal system can only be thoroughly understood through a familiarity with the origin, distribution, and relation of the nerves. The limits of this volume permit only a brief statement of the facts that the nerves are tubular cords of the same general substance or structure as the two great nervous centres, the brain and spinal marrow; originating in one or other of these, they extend to every part of the body, communicating frequently with one another, and having at such points of contact knot-like enlargements known as "ganglia," in which the nerves from the brain and those from the spinal cord unite, and which have been called "small brains," — centres of nervous action, as they send out the influence of both these nervous centres to the parts which they supply with nerves. In addition to the nerves proceeding from the brain and spinal marrow, there is a distinct nervous system — called "the great

sympathetic"—which, though communicating with both brain and spinal marrow, does not seem to be immediately under the control of either. Its special function is understood to be the supply of nerve-force to what are called the muscles of involuntary motion —those not under the domination of the will—such as the muscles of the heart, stomach, intestines, etc.

Impressions are conveyed from the nervous centres —the brain and spinal marrow—to the surface of the body, as well as from the surface to the nervous centres.

The different nerves have various functions. Thus, there are nerves of special sense, as those concerned in hearing, seeing, smelling, tasting; nerves of sensation; nerves of motion; nerves combining sensation and motion; nerves belonging to the voluntary muscles, as those of the arms and legs; and nerves distributed to the so-called involuntary muscles. The irritation of a nerve of sensation causes pain; of a nerve of motion, muscular contraction; of the nerve of the retina, the sensation of light; of the auditory nerve, the sensation of sound.

"Sympathy" depends upon the connection that exists between two organs more or less distant from each other, so that an affection of one is transmitted to the other. The sympathy may be that of contiguity (nearness) or that of continuity. The former is illustrated by the earache, which is frequently asso-

ciated with an aching tooth; the latter by the extension of an irritation or inflammation throughout a membrane that is continuous—as, for instance, in the sore mouth sometimes associated with a disordered stomach. By "reflex" is meant the peculiar phenomenon of an impression which originated at one point and was transmitted to the nervous centres, and then referred to another point more or less distant from the source of the irritation; illustrated by the angle described by an elastic ball when thrown obliquely against a wall. The ball does not return as when it is thrown at right angles to the wall, but flies off at an angle corresponding to that at which it was impelled. This reflex action is constantly exemplified in the complaint of pain in a tooth in one jaw when the irritation originates in the other.

There are twelve pairs of nerves originating in the brain, and thirty-one in the spine. The fifth nerve, having its origin in the brain, and diagramatically represented in Fig. XXII., is the largest of the cranial nerves. Its functions are various. It is the great sensitive nerve of the head and face, the nerve of the special sense of taste, the nutrient nerve of the teeth, and the motor nerve of the muscles of mastication. It is called the "trifacial," because it is divided into three main branches known as the "ophthalmic," the "superior maxillary," and the "inferior maxillary." These main divisions again subdivide, and

give off branches to the eye and eyelids, the nose, the ears, the forehead, the scalp, the upper and lower lips, the chin, the gums, the tongue, and the teeth of the upper and lower jaws; filaments of the maxillary

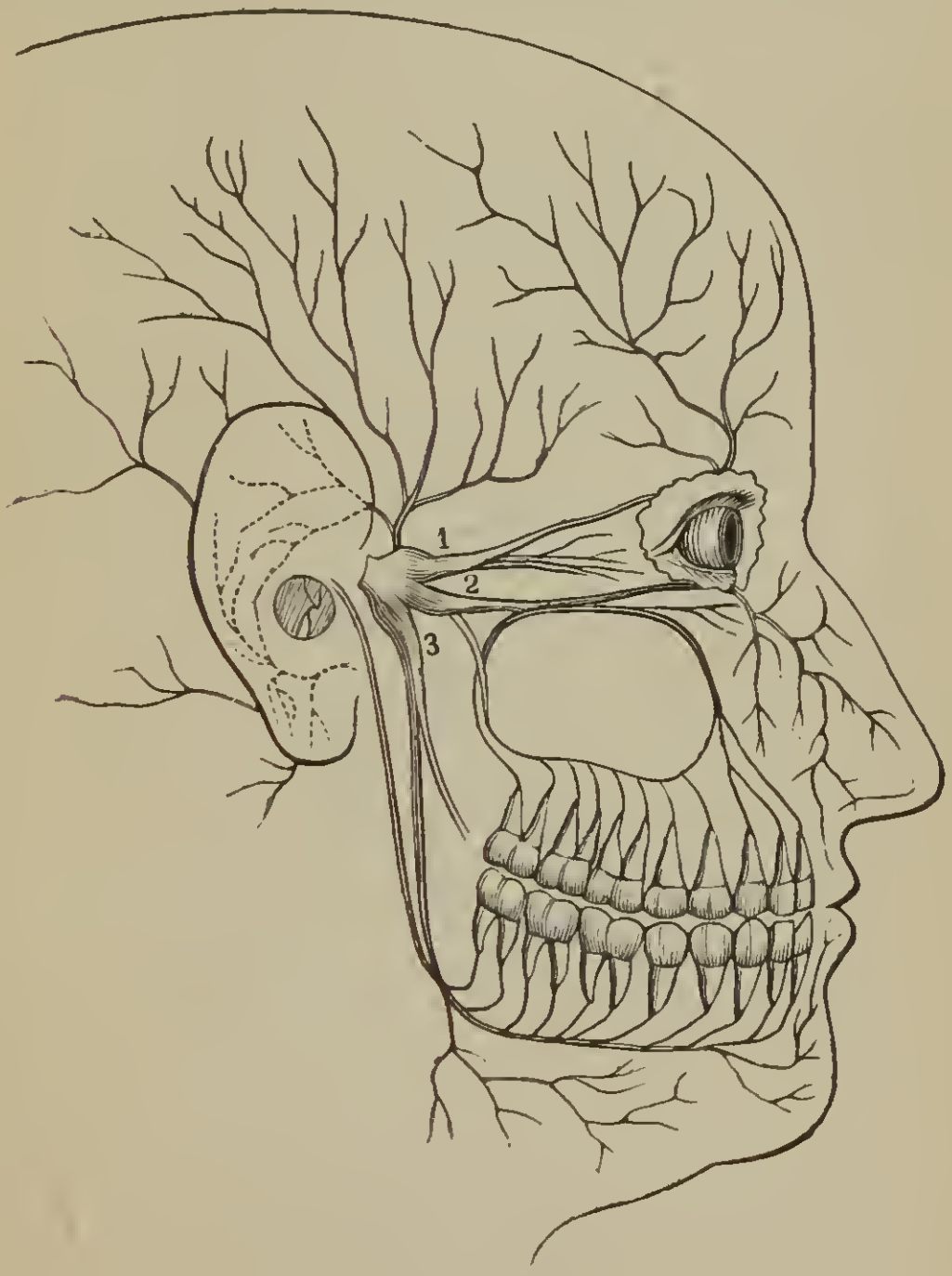


Fig. XXII.

branches again join the ophthalmic branch and the seventh nerve — the nerve to the muscles of the face. The fifth pair of nerves is remarkable on account of its frequent communication with the sympathetic nervous system, as well as its numerous ganglia and its varied functions. It is this nerve which is specially affected during the eruption of the teeth, whether of the primary or permanent set. It is the irritation of this nerve during dentition which causes convulsions in children. It is this nerve which is the seat of facial neuralgia. It is the relation which this nerve bears to the head and face which is the cause of the various "sympathetic" affections of the eye, ear, etc., so commonly associated with dental disorders. Painful sensations resulting from irritation of one of the branches of this nerve in the mouth are reflected not only to neighboring but to remote organs. Attention is naturally called to the teeth in those cases in which pain is experienced in one or more of them; but frequently dental derangements, which have subsequently been proved to be the exciting cause either of constitutional disturbance or of pain in other organs or of interference with their functions, have failed to attract attention by reason of the absence of any decided tokens of irritation in the teeth. In such instances the announcement to the patient that pain outside of the mouth is in any way related to the teeth is generally received with

distrust of the opinion, if not of the practitioner who ventures the statement. Many cases are recorded, illustrating how variously such reflected troubles may express themselves, and how little reason there frequently may be to suspect the origin of the difficulty. There may be no cavity of decay, no pain, no soreness, no external sign of trouble, but, from an enlargement of the roots, — a disease called exostosis, — or from deposits in the pulp cavity of a tooth, there may be a disturbance, from pressure, which will be reflected to the eye, the ear, or other organs, or may even cause general derangement of the health.

General systemic disturbances, resulting from diseased dental organs, might be considered as impossible, were it not for the instances with which every dental practitioner is familiar, in which debility, sleeplessness, nervous derangements, mental depression, palpitation, etc., after resisting constitutional medication, have yielded promptly to such treatment as was found necessary to restore a healthy condition of the mouth. Indeed, so frequently have fretful, nervous, irritable, despondent conditions been found to depend upon dental troubles, that it would appear to be a plain duty, in the event of failure to discover other causes for such manifestations, to have the mouth and teeth carefully examined by a competent practitioner. So many and so varied are the disturbances radiated or reflected to other organs, or depend-

ent upon constitutional irritation from dental affections, that their enumeration in detail would be tedious; but the inharmonies thus set up may range from a mere sense of discomfort up to and include the gravest and most formidable derangements, involving even life itself.

But the sympathetic or reflex disturbances of harmony, caused by dental irritation, are not more interesting or instructive than are the converse manifestations of pain or discomfort experienced in the teeth but originating elsewhere. A curious and familiar illustration, which will help to an understanding of these, is found in the effect produced on many, if not most, people through an irritation of the auditory nerves by discordant or peculiar sounds, such as those produced by the sharpening of a saw, the cutting of cork, etc., which not only "set the teeth on edge," but send a thrill through the system which is described as "making the blood run cold." Similar effects are produced on impressible organizations by the contact of the hand or fingers with certain substances. Many persons have their teeth set on edge and their blood made to run cold by touching velvet. Even those who have lost all their natural teeth and wear artificial substitutes assert that discordant sounds, as well as the taste, even the smell, or sometimes merely the mention, of sour fruits or drinks, will cause their teeth to feel "on edge;" just as those who have lost

a limb by amputation complain that they still suffer at times from itching, pain, or uncomfortable sensations in the missing member. Many of the instances of painful affections of the fifth nerve are well-marked examples of reflected sensations, the primary irritation being in the stomach or intestinal canal. The pain over the eyes so commonly associated with derangement of digestion, and which may frequently at once be relieved by correcting the acidity of the stomach, is a familiar instance. The condition popularly known as "biliousness," among numerous other manifestations, not seldom reveals itself to the observing sufferer by a peculiar discomfort produced in the teeth, which, variously described, may be summed up under the general phrase, "exalted sensibility." An attack of dyspepsia is by many more quickly recognized through disagreeable sensations in the teeth than by any special stomach disturbance. In sea-sickness and in sick headache the nausea is sometimes preceded by intense neuralgia in the teeth and jaws, promptly disappearing if vomiting be induced. In some people hunger will excite markedly disagreeable sensations in the teeth. A case in point is that of a gentleman who, while convalescing from typhoid fever, was seriously annoyed by painful sensations in two of his molars whenever he became hungry. These uncomfortable sensations would rouse him from sleep, and could not be allayed except by

the introduction of food into the stomach, when instant relief followed. In another curious case of nervous debility the approach of a thunder-storm or a marked atmospheric variation always produced a most tantalizing sensation of discomfort in the teeth, causing them to feel as though they were denuded of enamel. The singular affection known as "brow ague" or malarial neuralgia—which, by yielding to quinia, reveals its malarial origin—is frequently alternated or is associated with periodical pain in perfectly sound teeth. Neuralgia (nerve pain) furnishes various illustrations of reflex or radiated pain, the cause being in a nerve centre in the brain, in the trunk of a nerve or in its extremity, or, by exchange of communication, in the sympathetic nervous system. Thus, a neuralgia originating in a diseased tooth may express itself in the face, scalp, eyes or ears, or in more remote parts, while by the same methods of radiation or reflection, reversed, a neuralgia having a general or constitutional cause, as malaria, or a local cause in the stomach or elsewhere, may manifest itself in one or more teeth. There is a form of toothache, not inappropriately termed "hysteric toothache," which seems to depend upon emotional rather than physical excitants, and is more amenable to mental impressions than to local or general medication. Rheumatism sometimes produces agonizing pain in the jaws, and either

by direct influence, by the sympathy of contiguity, or by radiation, may so powerfully affect an individual tooth that the patient can hardly be persuaded that instant and complete relief would not follow its extraction. It is apparent, therefore, that many severe, remote, sympathetic, and reflex derangements may be associated with and dependent upon affections of the teeth. It is a sad mistake for either the dentist, the physician, or the patient to consider the teeth as mere mechanical organs, requiring only mechanical treatment, and to therefore ignore their nervous relations to the entire organism.

CHAPTER XIII.

CONSTITUTIONAL PECULIARITIES, VARIETIES, AND DEFECTS OF THE TEETH.

CONSTITUTIONAL peculiarities, or differences existing between individuals, which are designated as temperaments, and which are variously manifested in height, weight, build, complexion, color of eyes and hair, etc., are nowhere more distinctly observable than in the mouth. The size, form, color, and density of the teeth; the time and order of their eruption; the character of the enamel — its perfect or imperfect continuity; the shape of the roof of the mouth — a broad and flat or narrow and high arch; proportion or disproportion of the jaws relatively to the head and face or to each other; the length and size of the tongue; the thickness and muscular power of the lips; the character of the mucous membrane of the lips, cheeks, and gums — these and various other distinctive differences are marked evidences of constitutional peculiarities. The teeth, in their physical characteristics, considered individually or relatively to each other and

to the arch of the jaw, exemplify hereditary transmission, as well as the impressions made upon them during their formative stage. The former is illustrated by the reproduction in the children of peculiarities in the teeth of their parents; the latter, by the constant proneness of the teeth to decay in pairs, showing that the unfavorable impression which caused their defective structure was made upon both alike. Hare-lip and cleft-palate are examples of defects dependent upon some arrest of development of the child before birth, and show also the tendency to hereditary transmission of physical imperfections. The differences between individuals in the physical character of the teeth (differences in their organization, ossification, and density, and consequently in their healthfulness, usefulness, and durability) are generally in harmony with other constitutional peculiarities. The size, shape, and structure of the teeth indicate also their liability to decay or their power of resistance to unfavorable conditions. The character and progress of decay vary also in the several temperaments not less than does the original structure — liability to decay and its character and progress being, however, much modified by the state of the general health. Teeth poorly organized may, by reason of favorable systemic conditions, and intelligent, persistent care, be made to outlast those of vastly superior original structure, but which succumb

to unfavorable constitutional conditions, or to neglect.

Teeth regular in their positions, of large size, of a rich yellow or yellowish-brown color, with dentine dense as ivory, and enamel (perfect in its crystallization and in smoothness and hardness like glass) thickly and evenly deposited, represent a vigorous, healthy constitution. Those irregular in their positions, small, stumpy, and incongruous both individually and relatively; opaque and chalky, with enamel only semi-crystallized, deficient in quantity, and irregularly deposited; the dentine soft or friable, represent constitutional poverty. Teeth of the first class exhibit ability to resist unfavorable local and systemic influences, in keeping with the vitality inherent in them; while those of the other class have feeble power of resistance to unhealthy conditions, in consonance with the defective organization with which they are associated. Modifications of every possible variety, in physical outline, in elementary constitution, and in size, color, and density, show the relative wealth or poverty of the organization; show not infrequently the blending of the characteristics of the parents — in some respects indicating the organization of one parent, and in some the peculiarities of the other.

Even in the same mouth some teeth are more susceptible to decay than the rest, owing to constitutional conditions at the time of their formation, resulting in different degrees of density in their texture, and

consequently of capability to resist the action of destructive agents. The deciduous teeth show by differences of organization the varying health of the mother during their development, as the permanent teeth exhibit disturbances occurring during their formative stage. The temporary interruption of nutrition by acute infantile diseases, such as measles and scarlet-fever, is generally recorded distinctly in the dental organs.

In addition to the imperfections described as resulting from systemic conditions (either of the parent or child), during the formative period of the teeth, it is important to note another variety of defects not infrequently associated with otherwise perfect dental structures, viz., that resulting from incomplete union of the enamel at various points in the depressions found on the grinding surfaces of the molars and bicuspids. These flaws in the continuity of the enamel favor the lodgment and retention of food and of the secretions of the mouth. At such points decay is almost sure to occur, frequently extending unsuspected underneath the enamel until the integrity of the tooth is seriously impaired. Fig. XXIII. represents a vertical section of a molar magnified, in which *a* is the fissure caused by a failure of the enamel edges to unite.

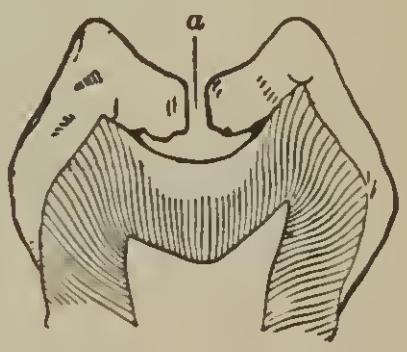


Fig. XXIII.

CHAPTER XIV.

IRREGULARITIES OF THE TEETH.

THE value of the teeth, not only for ornamentation and vocalization but also for utility in mastication, depends very much upon their regular position in the arches of the jaws and upon their perfect occlusion. In a faultless denture the upper and lower teeth come together in such a manner that the elevations and depressions upon the opposing surfaces fit into each other so as to produce the most effective results in mastication. When from any cause this perfect occlusion is prevented, their usefulness is more or less impaired. The deviations from regular position and occlusion are various and numerous. The disadvantages resulting include imperfect mastication with its consequent derangements, faulty pronunciation, interference with the thorough cleansing of the teeth, thus increasing their liability to decay; irritation of the gums, tongue, lips, or cheeks, and disfiguration of the countenance. The inconvenience is more or less serious, and the deformity more or less conspicuous, according to the character and extent of the

deviation. The irregularity may be limited to a false position of one or more teeth, or may involve the entire denture; may be the result of some extrinsic cause, or of an incongruity of size between the teeth and the jaws. A single tooth is sometimes twisted upon its axis, overlaps the adjoining tooth, or erupts inside or outside of the arch. The latter occurrence — a frequent one with the canines — is generally a source of great annoyance, interfering seriously with the symmetry of the face. Sometimes the upper front teeth shut edge to edge against the lower, instead of overlapping them, causing a rapid wearing away of the edges of both. In other instances the upper teeth shut so far outside of the lower ones that they rest upon the lower lip; or they protrude so that the upper lip fails to cover them. Another variety of irregularity is that in which the teeth of the lower jaw close in front of the upper teeth — an inversion of order which in the dog is known by the name of "underhung." Another but rarer form of irregularity is that in which the molars alone come in contact when the mouth is closed, causing the front teeth to stand apart.

Irregularities of the teeth proceed from a variety of causes, among which may be mentioned mechanical injuries, such as blows upon the mouth; the presence of supernumerary or extra teeth; a steady pressure, such as is kept up during the habit of sucking the thumb or fingers, tongue or lip, during childhood; a

too early extraction of some of the temporary teeth, especially of the molars and canines; a wrong direction given to one or more teeth by a mechanical impediment, such as the retention in the mouth of temporary teeth, or even roots of temporary teeth, after the time when they should have been removed; hereditary transmission of dental peculiarities; the incongruous association of large teeth with small jaws,—a mixing without blending of differing parental characteristics,—as, for instance, large jaws and large teeth in one parent, and small jaws and small teeth in the other; if the small jaws of one and the large teeth of the other be associated in the offspring, the result will be an overcrowded denture.

Children with enlarged tonsils are liable to an irregular disposition of the teeth as a result of the habitually open mouth caused by the difficulty of breathing through the nose.

Fig. XXIV. illustrates the type of deformity resulting from the habit of thumb-sucking. A similar protrusion of the teeth of the lower jaw is produced by the habit of sucking the first and second fingers, the weight of the hand and arm gradually forcing the teeth out of position.

In many instances children are allowed to retain the bottle from which they have nursed, or are supplied with a sugar-teat, or are permitted to suck the thumb or fingers, because of the quieting effect which

this occupation seems to produce. The resulting deformity of the jaws, and the consequent irregularity of the teeth (crowding, overlapping, or protruding), produces disfiguration and causes disabilities and discomforts which remain throughout life.

Fig. XXIV.

It is much easier to prevent these habits or to break them up in their incipiency than after they have been fully formed, although in some cases the sucking instincts of the child make their prevention or early correction no easy task to the anxious parent. The sugar-teat can be denied; the nursing-bottle may be removed as soon as used; but the fingers and thumbs are not so easily disposed of, and probably the absolute imprisonment of the hands will in many instances be required. Watchfulness by the mother or attendant during the child's waking hours will be sufficient to prevent the indulgence; but during sleep *extra* precautions are necessary. A plan which has been success-

fully resorted to, and which is commended for its simplicity and efficiency, is to have the child's night-dress made without sleeves, like a pillow-case, and fastened by a drawing-string about the neck. Certainly no pains which are necessary to save the child from the evil effects of the pernicious habit of fruitless sucking should be considered onerous.

Chief in importance in the list of causes of irregularity is defective growth of the jaws during the development of the permanent teeth. In a perfectly healthy person the teeth and the jaws would develop harmoniously; but it is quite possible for one or the other, or both, to suffer in development, according to the character of the disturbing influence.

That the operation of some of the causes named may be clearly understood, it must be remembered that previous to the eruption of the teeth their roots are not closely embraced by the bony sockets, as they are after they have erupted. During the development of a tooth the socket is necessarily large enough to contain the crown, which is comparatively so much larger than the root that, after the former has emerged from the socket, the tooth is surrounded only by soft and yielding tissues, and hence is readily diverted from its course by even a very slight impediment. It must also be remembered that the size of the crowns of the permanent teeth is determined long before their eruption, and is not subject to subsequent modi-

fications; that the development of the teeth and that of the jaws proceed independently of each other, and that the teeth erupt according to their original formation, even though the jaws be hindered in their growth. Bearing in mind these facts, it is easily understood that any subsequent interruption or interference with the development of the jaws must necessarily result in a crowded condition of the teeth. It is to such interruption, it is believed, that many of the irregularities witnessed in the mouths of the present generation are directly traceable. If the brain and nervous system be unduly stimulated; if more attention be bestowed upon the child's manifestations of intelligence than upon the growth of the body and the general vigor of the system, the muscular and bony structures must suffer. An undue or precocious mental development is attained at the expense of the rest of the organism. An indoor life, late hours, stimulating food, overheated sleeping apartments, surroundings which in any way invite and encourage mental precocity, can result only in a disturbance of the proper balance or symmetry of development — the bony and muscular systems and the functions of animal life being sacrificed for the sake of a brilliant but probably brief intellectual ascendency. During the first seven years of a child's life, the brain and nervous system, far from being stimulated, should be carefully, persistently, earnestly,

anxiously guarded, and their development repressed instead of favored. There is no necessity to teach a child under seven years of age anything but morals and manners. Whatever is added to these in the way of education tends to inharmony of development — a nervous and mental precocity at the expense of the physical organism; tends not only to a crowded denture, to imperfect organization of the teeth, and to their early decay, but to a *general* physical imperfection, and too often in addition to subsequent mental incapacity or aberration. Out-door life, childish pursuits, plain and wholesome food, long periods of repose — all things, in fact, which favor the health and growth of the physical organism — promote the health and growth of the jaws and teeth, and at the same time favor a mental development which, though of slower growth, is likely to be symmetrical, vigorous, and permanent.

It is much easier to avoid decided irregularities of the teeth by attention at the proper time than to correct them at a later period. The nutritive functions are more vigorous and the processes of absorption and reconstruction more active in early life than subsequently. If, therefore, changes of position of one or more teeth are necessary to the correction of an irregularity, an easy adjustment is permitted in childhood, which a few years later would be tedious, difficult, and uncertain. One of the reasons for in-

terference at an early period, when a tendency to irregularity is to be combated, is because of the fact that false positions of the teeth are made difficult of correction when those of the opposite jaw in closing prevent them from assuming their correct relation to the arch of the jaw.

The causes and forms of irregularity are so numerous and various that no rules can be laid down for treatment. The natural expansion of the jaw up to a certain period, the extent of the irregularity, the character and condition of the teeth, the age of the patient, and various other considerations, will determine the judgment of the dentist. Under the care of a competent adviser, the prevention or correction of most forms of irregularity is neither difficult nor problematical, if the proper effort be made in time.

CHAPTER XV.

TARTAR, OR SALIVARY CALCULUS.

THE liquid (saliva) found in the mouth is, as has been heretofore explained, the product of various glands. It contains in solution animal and earthy matters which are liable to be precipitated upon coming in contact with the atmosphere, or by reason of the changes of temperature to which it (the saliva) is subjected in the mouth. These precipitates, composed as stated of both animal (organic) and earthy (inorganic) matters, mixed with mucus and with various accidental substances (alimentary *débris*) found in the mouth, are deposited upon the teeth. This deposit is called "tartar" because of its resemblance to the article so named which is precipitated from wines and adheres to the sides of the casks in the form of a hard crust.

The quantity of tartar deposited varies in different persons and at different periods, as do also its chemical and physical characteristics. It is sometimes composed almost entirely of earthy or inorganic ingredients; sometimes it is largely made up of animal mat-

ters; sometimes it is of almost flinty hardness, and in other cases so soft that it can be scraped off with the finger-nail. Its color is not uniform, but may be black, brown, green, yellow, or nearly white.

The amount and character of the injury caused to the teeth, gums, and sockets by the different forms of tartar vary as greatly as the quantity, composition, density, and color of the deposit. Some varieties form in thin, hard scales, which can be chipped off with an instrument. Other forms are characterized by a rough, uneven surface and an exceedingly tenacious adherence to the teeth. In other cases it has a consistence more like that of cheese. Some forms are more correctly described as stains than as deposits. Some kinds of tartar are inodorous, while others are insufferably fetid and offensive. Some act chiefly as mechanical irritants to the gums and to the edges of the alveolar processes; others possess an acrid character, corroding the surfaces of the teeth on which they are deposited, and causing rapid decay.

Tartar is deposited most rapidly upon such teeth and such parts of the teeth as are nearest the openings of the salivary ducts, and is likely to remain upon the surfaces which are least exposed to the friction of mastication. The inner surfaces of the lower incisors and the outer surfaces of the upper molars are, for both of the reasons stated, most likely to suffer. Gravity also favors its lodgment on the

teeth of the lower jaw. The greatest accumulation takes place during the night, because, the teeth not being used in mastication, and the fluids of the mouth not being kept in motion by the movements of the tongue, lips, and cheeks, there is nothing to interfere with its attachment.

In certain cases the mischief occasioned by the presence of tartar seems out of all proportion to the amount of the deposit, which insinuates itself around the necks of the teeth, beneath the free edge of the gums, working its way insidiously towards the roots, thus separating the gums from the teeth and the roots from their enveloping alveolar processes; producing inflammation, sponginess, and suppuration of the margins of the gums, and causing them to bleed at the slightest touch; making the use of the brush exceedingly painful; interfering with mastication; making the breath offensive; vitiating the fluids of the mouth, and thus creating irritation of the throat and bronchial tubes, indigestion, and general derangement of the health. The early stages of this condition are manageable, but the only treatment available is the thorough removal of the tartar by a competent dentist; scoring the gums and the use of astringent washes being worse than useless. After the removal its re-accumulation must be guarded against with the utmost care.

There is a variety of deposit or stain which is

exceedingly deleterious. It is of a greenish-brown color, and is frequently to be found on the front surfaces of the upper permanent incisors of children. Owing to its position beneath the lip, it is undisturbed by the act of mastication, by the fluids of the mouth, or by the movements of the muscles in speech. It is very tenacious, and has an offensive odor, or at least accompanies a vitiated mucous secretion, which renders the breath offensive. Its destructive effects are made manifest by furrows eaten through the enamel across the teeth just below the margin of the gums. The teeth of young people are frequently ruined by this variety of deposit. The affection seems to depend upon a diseased condition of the mucous glands, the deposit recurring quickly after removal. Treatment should be directed to a *correction of the cause*, as the mere removal of the deposit will not result in any permanent benefit.

CHAPTER XVI.

DECAY OF THE TEETH, OR CARIES.

DECAY of the teeth is an affection which is almost universal. It may be defined as a disintegration of the tooth-structure, affecting the enamel, the dentine, and sometimes, though rarely, the cementum. It always commences on the exterior of a tooth, and is dependent chiefly upon external influences, though it may be modified by constitutional conditions.

The causes of decay are predisposing and exciting. The predisposing causes are imperfect structure, irregularity of position, and mechanical injuries. Conditions inherent in the teeth by virtue of their original structure, determined before birth or during infancy, establish in many cases a predisposition to decay. Owing either to imperfect health of the mother during the development of the teeth, or to disturbances of the health of the child during their formative stage, the various processes of organization are liable to be so interrupted and deranged as to result in defective dental structures. The dentine is soft and friable; the enamel semi-crystallized and deficient in quantity

or quality — a heterogeneous mixture of animal and earthy materials. Teeth thus imperfect in their texture are necessarily not fitted to resist the action of destructive agents. The same may be said of those with deep fissures whose edges are imperfectly joined.

Irregularity of position, from whatever cause, renders the teeth liable to decay. When they lap over one another, or touch at points other than those which are intended to come in contact in a natural and orderly arrangement, decay at such points is apt to occur. The difficulty of keeping irregular teeth clean is another fruitful cause of decay, the retention of food being favored by their positions.

Mechanical injuries — falls, blows, and improper use of the teeth, destroying the continuity of the enamel — also predispose to decay.

The exciting causes of decay are chiefly different forms of chemical action, which may either follow from the use of acids as food or medicine, or be caused by improper tooth-powders or washes ; or may result from a vitiation of the secretions of the mouth, either from a general systemic derangement or from a local cause, such as mumps, sore throat, or the presence of tartar about the necks of the teeth causing an irritation of the gums and inducing an acid secretion ; or from the fermentation and decomposition of food about and between the teeth. This latter is beyond question the chief cause of caries. It is well known that in the fer-

mentation or decomposition of animal or vegetable substances acids are generated. Every housekeeper is aware of the liability of milk, catsup, and various other household supplies to *turn sour*—a result caused by the development of a microscopic vegetation called the "yeast plant," the change taking place more readily in warm weather than in cold. Under favoring circumstances a like growth (facilitated by the heat and moisture) takes place in the mouth, and acts upon the mucus and saliva as a ferment. The little masses of food impacted in the crevices and between the adjoining surfaces of the teeth thus become so many heaps of decomposing or fermenting material, generating acids which attack and destroy, particle by particle, the tooth-structure. The effect of a weak acid upon a substance which, like the teeth, is largely composed of a form of lime, may be seen by the submersion of an egg in vinegar. In a few days the egg will be entirely deprived of its shell. This exemplifies the manner in which the acid, generated by fermentation of food, mixed with the secretions of the mouth, attacks, disintegrates, and dissolves the lime of the tooth. Decay never begins on the smooth surfaces of teeth — those which are exposed to the friction of mastication — but always commences at points which, owing to their structure or to their arrangement, furnish convenient receptacles for decay-producing agents. The points most favor-

able to such retention are the deep fissures of the bicuspids and molars and the approximate surfaces of the teeth. In these crevices, and at the surfaces which the teeth present to each other, and which favor the lodgment and retention of food and mucus, decay is most likely to begin, and once begun to continue. It proceeds slowly, perhaps, so far as the enamel is concerned, but when it reaches the dentine, either through a fissure in the enamel or a breach made through its walls, it progresses more rapidly until the pulp is reached, and its vitality and the strength and substance of the tooth are destroyed. Decay proceeds much faster when once a cavity has been formed in a tooth because the destructive materials are there held in constant contact with the tooth-structure; not, as is generally supposed, because the dentine is so much more susceptible to their action than the enamel. Smooth, well-polished dentine, such as is left by careful operators after making what is called a permanent separation between adjoining teeth, resists decay in many cases almost as well as the enamel itself.

The character of the disintegration to which the teeth are liable differs, as does their original formation, in different individuals, the decay being dark, white, dry, moist, horny, soft, chalky, or cartilaginous, according to the quality of the original structure and the strength and activity of the solvent;

also somewhat according to the systemic conditions of the individual. The teeth are a part, and an exquisitely organized part, of the animal economy. They must, therefore, be more or less influenced by the state of the general health. They are liable to considerable modification of their texture by varying constitutional conditions, becoming softer at times, and therefore more likely to be injuriously affected by decay-producing agents. Moreover, morbid secretions of the mouth in deranged systemic conditions tend markedly to the production of caries. Slight irritation of the mucous membrane, such as is caused by the presence of tartar which has insinuated itself between the gums and the necks of the teeth, will provoke a mucous secretion decidedly acid, and as decidedly destructive to tooth-structure. Derangements of the alimentary canal are generally accompanied by acidity of the saliva. During pregnancy the saliva is generally acid in character, which fact, in addition to the softened condition of the teeth themselves previously alluded to, accounts for the rapid decay which is undoubtedly apt to take place at such times. In all acute inflammatory diseases, and in all chronic affections of the digestive tract, there is increased viscidity of the mucous secretions of the mouth with a marked diminution of the saliva, tending to the production of caries. In dyspeptic troubles there is generally an acid condition of the diges-

tive fluids, which are regurgitated from the stomach to the mouth and act directly upon the lime of the teeth.

In addition to the acids, resulting from derangements of the stomach and alimentary tract, or from the mucous and salivary glands, or from the fermentation or decomposition of food about the teeth, there is another agent which is supposed to play an important part in the extension of caries, viz., a vegetable parasite — a fungus — found in the interstices, furrows, and depressions of neglected teeth, but most abundantly in cavities of decay. It is not claimed that this fungus originates decay, but that it becomes an active agent in the destructive process when once a loss of substance has been caused in the enamel — its filaments penetrating the minute chinks, excavations, and orifices caused by disintegration, and opening the way for the entrance of chemically destructive agents. The development of this fungus seems to be favored by an acid condition of the mouth. Treatment, therefore, which corrects the acidity lessens the danger. Antacid washes, especially washes or powders containing soap, hinder the development of the parasitic vegetation.

Whatever may be said of the deleterious effects of tobacco upon the general system, it has not been proved to have any influence in the production of caries, although the discoloration which results from

its continued use detracts markedly from the appearance of the teeth. In this connection it may be mentioned that the use of a clay pipe produces a rapid abrasion of the teeth between which it is held, and that short pipes are charged with the development of cancerous affections of the tongue and lips.

Sugar and confections exercise no *directly* injurious effects upon the teeth, but when taken in excess do produce an acid condition of the stomach unfavorable to the health of the mouth, and when left in the interstices of the teeth rapidly undergo an acid fermentation, resulting in a product capable of acting very injuriously upon tooth-structure. Particles of candy remaining between the teeth will, in a single night, produce demonstrable mischief.

The progress of decay of the teeth is as varied in different individuals and at different times as is the character of the disintegration. It proceeds sometimes insidiously and slowly, and again with wonderful rapidity; sometimes announcing its ravages by a sensitiveness of the exposed dentine to sweets and acids and to changes of temperature, and at other times giving no notice of its presence until a complete exposure of the pulp has been made.

CHAPTER XVII.

TOOTHACHE — EXTRACTION — HEMORRHAGE.

PAIN or discomfort in or about a tooth may arise from a variety of causes. In perfectly sound teeth rheumatism sometimes causes distressing pain, which may be located in one or two teeth, or involve half of a jaw, or even the entire jaw. Neuralgia, originating as it does very frequently in diseased teeth, may have its origin elsewhere and manifest itself in teeth which are perfectly sound. Valuable teeth are often sacrificed from this cause. Pain is frequently experienced in a tooth which is only sympathetically affected. These facts have been explained in the chapter on "The Nervous Relations of the Teeth." A recession of the gums and alveolar process from about the neck of a tooth, exposing the cementum, gives rise in some cases to a dull and annoying ache. Particles of tartar which have found their way between the gum and the alveolar process may occasion soreness and distress, if not acute pain. The disease known as *exostosis*, which may be described as an unnatural enlargement of the

root of a tooth, is often the cause of constant uneasiness, and sometimes of distressing pain. In some cases there is a peculiar deposit in the pulp of a tooth of granules of bone-like material which causes severe neuralgic, generally paroxysmal, pain, sometimes located in the tooth (which yet gives no evidence of trouble, either by soreness, discoloration, or decay), and sometimes reflected to the eye, ear, scalp, or elsewhere. The death of the pulp in a tooth—the result of a fall, blow, or other accidental or voluntary violence, or from some unexplained cause—becomes the occasion of unbearable pain when the products of its decomposition are confined in the pulp cavity. Some teeth, in which a cavity of decay has exposed the dentine, become exceedingly sensitive to the influence of irritating agents. In such cases sweets or acids taken into the mouth, or cold or hot drinks, or even the secretions of the mouth, will occasion pain.

Chief in frequency, however, of the causes of pain in a tooth is the absolute or approximate exposure of the pulp, which, as has been previously explained, is located in a cavity having the general form of the tooth and protected on all sides by its walls. When by the agency of decay the overlying floor of the cavity becomes so thin as to be permeable, the result is an irritation of the delicate and exquisitely organized pulp, and consequently acute pain. When

the protecting wall of dentine has been so far disintegrated as to expose the pulp, the latter is liable to constant irritation by contact with food or drinks, with the secretions of the mouth, or even with the atmospheric air. A small defect in the continuity of the dentine is likely to result in greater distress than would ensue from a complete exposure, for the reason that in the latter case the swollen pulp has room for its enlargement, while in the former the unyielding walls of the tooth confine it. The pressure makes manifest every pulsation of the heart, causing that form of anguish known as "jumping toothache." Those who have experienced this pain need no description of it; those who have not, would do well to avoid a practical acquaintance with it.

Still another form of pain in connection with teeth is that which is occasioned by an inflammation of the membrane surrounding the roots and investing the sockets. This affection is known by the name of *periodontitis* — inflammation about a tooth. The condition may be either acute or chronic, and may be the result of the continued influence of neuralgia, gout, or rheumatism; of the irritation of deposits of tartar between a tooth and its socket; of mercurial poisoning, or of one of the eruptive fevers (measles, scarlet-fever, small-pox, etc.); of an attack of scurvy; of degenerative changes from age or other causes, either in the membrane itself or in the roots of the teeth; of

false (premature) occlusion of a tooth in mastication, either because of its position or of an undue prominence of a filling on a crown surface, and of mechanical violence — accidental, voluntary, or from the injudicious use of the mallet in filling, or from excessive wedging to separate the teeth for examination or operation.

The acute or active form may be the result of "a cold settling in the jaws," as it is commonly expressed, and generally subsides after a few hours or days of discomfort. The most common and the most severe form of periodontitis, however, is that which is associated with disease or death of the pulp in a tooth. Teeth in which an unsuccessful attempt has been made to save an exposed pulp by "capping," as well as those in which the pulp has been devitalized but its complete removal not accomplished, are liable to periodontitis, especially during sudden changes in the weather, or as a result of a disturbance of health in the individual. Periodontitis usually commences with a scarcely noticeable uneasiness in the tooth, but deepens into a dull, heavy, sometimes throbbing, persistent pain. From the swelling of its investing membrane, the tooth projects beyond its fellows, compelling a discontinuance of all masticatory efforts for the time being. The pain increases in intensity, and is accompanied by more or less swelling of the face. Unless the diseased action be arrested by

treatment, an abscess forms at the root of the tooth, the resulting pus generally finding its way to the surface of the gum opposite the abscess, or at some other point in the mouth, forming what is popularly known as "gum-boil." After the discharge of the pus the pain subsides, and the swelling gradually disappears. But the disease is not cured, and after a longer or shorter period, depending on various circumstances — notably on the good or the ill health of the individual — there will be a recurrence of the abscess. If this is repeated too often, the bony socket of the tooth becomes affected, the sockets of adjoining teeth participate in the trouble, the teeth lose their vitality and drop out, and sometimes necrosis (death) of a portion of the jaw follows. Sometimes the pus, instead of finding exit near the affected tooth, burrows among the tissues, and makes an outlet (called a "sinus") for itself at a distant point inside or outside of the mouth, not infrequently producing disfiguring scars on the face. When the symptoms indicate periodontitis, treatment should be instituted with a view to prevent the formation of an abscess, or, if this effort fails, to influence it to open at a desirable point — inside of the mouth, and not upon the face. Domestic treatment of this affection is usually wrongly directed, and that prescribed by the average general practitioner of medicine is almost equally at fault. The best possible advice which can be given here is to consult an

intelligent practitioner of dentistry at an early stage of the trouble, at which time it can frequently be aborted.

For the relief of toothache from approximate or actual exposure of the pulp, an application to the cavity of decay of a little ball of cotton saturated with oil of cloves, oil of peppermint, or phénol sodique in full strength, is perhaps the best amateur treatment where the cavity is easily reached. In other cases, holding in the mouth phénol sodique diluted with from three to six times its bulk of water will frequently alleviate the pain. But it must be remembered that, if the pulp is nearly or quite exposed, a recurrence of the pain is probable at any moment. For permanent relief the only efficient plan is to secure the services of a dentist. In the case of a child suffering from toothache in a temporary tooth, the difficulty of applying local sedatives directly to the cavity of decay is vastly increased by the fear (often well founded) that the affection will be aggravated by the lack of skill in the amateur operator, and by the exceeding amount of the salivary secretion, making it difficult even for an expert to operate satisfactorily. The disinclination to have in the mouth anything which tastes or smells unpleasant, or which produces any disagreeable sensation upon the mucous membrane, is a difficulty in the way of using such remedies as have been suggested. In these cases holding warm milk, or even

warm water, in the mouth will frequently give temporary relief.

It should be remembered that a tooth which has ached once will be likely to ache again, and an endeavor should be made to prevent a second attack in the same tooth by securing professional advice.

It is seldom that the extraction of a tooth becomes a necessity. Thousands of teeth are sacrificed through impatience, the result of the pain which ought to have been avoided by timely attention, and which might have been alleviated and the teeth preserved.

The facility afforded for the painless extraction of teeth by the use of nitrous oxide gas leads to the needless, wanton, wicked sacrifice of useful organs — to losses which can never be made good. The willingness of many persons to part with valuable teeth rather than take a little trouble and incur a small expense for their preservation, is an evidence of ignorance and of a readiness to submit to mutilation of the mouth as remarkable as general.

There is urgent need of a popular awakening to the fact that wilful neglect of the health of any portion of the body is criminal; that such neglect differs only in degree from suicide. The preservation of the integrity of the physical organism and of the vital forces, and the restoration of diseased or wounded members whenever possible, may be said to be the leading principle alike of surgery, of medicine, and

of dentistry. It should be the ambition of every individual to retain as long as possible each organ and faculty of body and of mind. But when it becomes desirable as a choice of evils to sacrifice a tooth, it is a weakness and a folly to allow it to remain through dread of the brief pain accompanying extraction. If its room is better than its company, and its displacement is demanded for conservative reasons, the sooner it is removed the better, both for the health of its neighbors and for the comfort of its owner.

The bleeding which follows the extraction of a tooth is usually of short duration and ceases without requiring any attention. In very exceptional cases it may be so profuse and long-continued as to demand treatment. The anxiety of the patient to have it cease leads sometimes to such constant interference as to effectually prevent natural cessation by the clot which would otherwise form in the socket. The first injunction, therefore, in such cases is, *do not disturb the clot.* If, in spite of such negative attention, the bleeding continues, resort may be had to the application of astringents or styptics, such as alum, tannin, catechu, kino, krameria, phénol sodique, or remedies which act mechanically, such as powdered resin, burnt cork, spider's-web, etc. Of the various astringents, tannin is perhaps the most efficacious. Either that or powdered alum may be applied to the socket of the tooth on a small pledget of cotton. If these remedies

are not available, cobweb, which can generally be procured without much difficulty, may be rolled into a small pellet or ball and carried into the bleeding socket by a match-stick or piece of stout broom-corn. If the case be a stubborn one, and refuses to yield to such applications, *pressure* may be added. The little pledget of cotton carrying the tannin or other styptic should be dropped into the socket, which may then be compressed by a V-shaped saddle (made of cork or wood) so as to clamp the margins of the gum, and be held in place by the opposing teeth or jaw, assisted, if need be, by a bandage holding the jaws together. To divert the circulation to other parts of the body, hot foot-baths may be resorted to, and a sitting instead of a recumbent posture assumed, that the law of gravitation may also conduce to the desired result.

In exceptionally extreme cases, when such measures as have been indicated fail, further treatment should be instituted by the dentist or physician, and should include systemic medication.

CHAPTER XVIII.

HYGIENE OF THE MOUTH.

THE comfort of a pure breath and wholesome saliva, the agreeable effect produced upon others by the exhibition of a clean and healthy mouth, the advantage of the teeth in vocalization, the favorable impression made upon the general health by the ability thoroughly to masticate the food, exemption from the suffering which would be caused by diseased organs, and the possibility of the preservation and usefulness of the teeth till advanced life, are reasons sufficient, it would be thought, to induce every one to pay that attention to the health of the mouth which would secure such results. As far as the teeth are concerned, their liability to decay and the fact that, unlike other portions of the body, they are not endowed with the power to repair injury or replace lost tissue, so that when decay has destroyed any portion of their structure there is no possibility of its restoration, are most urgent reasons why they should receive intelligent and earnest care.

In the chapters on "Salivary Calculus" and "De-

cay of the Teeth" it has been shown that the accumulation of tartar about the necks of the teeth and the retention of food and other matters in their depressions and between their contiguous surfaces, there to undergo fermentation and decomposition, are the principal exciting causes of diseased gums, loosened teeth, and decay. It follows, therefore, that such deposits should be removed before they have had an opportunity to work mischief. There is no question that the one great essential to a healthy mouth is cleanliness. In fact, few even of those who pride themselves upon the care which they bestow upon their dental organs give to them the attention which their value would justify. Many otherwise intelligent people fail to appreciate the importance of taking due care of their teeth until compelled by suffering to do so. Then, when the demand has become imperative, their chief thought seems to be not how best to prevent further mischief and to retain what is left of their dental organs in as perfect a condition as possible, but how immediate relief can be secured, or else how painless extraction can be effected. It must not be forgotten that decay is not the only enemy of the teeth. The absorption of the gums and sockets caused by the presence of tartar is a liability which, though not absolutely confined to teeth which are neglected, is yet a danger specially threatening such. This result might in a majority of instances be prevented by

intelligent care — recession of the gums or absorption of the sockets rarely occurring in mouths that are habitually kept pure.

On the other hand, many scrupulously careful people bring about the evils which they seek to avert, by improper methods and appliances. Much mischief is wrought by the use of unsuitable brushes and injudicious brushing; by the use of tooth-powders and mouth-washes made in ignorance of the purposes to be subserved by their employment, and likely to do harm, either because of their chemical action upon tooth-substance, their unfavorable influence upon the health of the gums, or because of their containing ingredients likely to be deposited about the necks of the teeth and thus cause the absorption of the gums and alveolar processes. Simple measures regularly employed are sufficient for healthy mouths. In diseased conditions the wash or powder to be employed should be prescribed by an intelligent dentist. Patent nostrums and advertised powders and washes should be avoided. Any *wash* that is recommended for whitening the teeth is either incapable of accomplishing what is claimed for it or does so at the expense of the integrity of the enamel. The habitual use of astringent washes or powders, so far from being conducive to the health of the gums, is injurious. For certain purposes such dentifrices are of service, but their use should be discontinued as

soon as the object for which they are employed has been accomplished. Strongly alkaline washes are also injurious. Washes or powders containing alum, cream of tartar, charcoal, ground barks, or acids of any description, are injurious either because of a chemical action upon the teeth or because their insoluble ingredients are apt to insinuate themselves under the margins of the gums. Tooth-powders containing excessively gritty or abrasive ingredients, or even those of ordinary abrasive power not sufficiently fine, do injury by roughening instead of polishing the enamel surfaces of the teeth. Perhaps there is no agent in common use for cleansing the teeth worthy of such utter condemnation as powdered charcoal. The results of its employment are exceedingly pernicious; the harsh, insoluble particles force themselves between the gums and the teeth, creating irritation, soreness, and inflammation of the tissues, and form nuclei for the deposit of tartar, resulting in the absorption of the alveolar processes, and in the loosening and loss of the teeth. Its continued use also causes the gums to assume a *tattooed* appearance, like that which India-ink produces when pricked into the flesh.

A mouth-wash may be anodyne, astringent, disinfectant, stimulant, or tonic, according to the indications; but, if the secretions are natural and the gums healthy, the wash should merely be pleasant to the taste, agreeable in odor, and slightly antacid or sapo-

naceous — not astringent. A tooth-powder, for a healthy condition of the mouth and teeth, should be merely a mechanical agent, possessing a hardness sufficient for the removal, without liability to injure the enamel, of slight accumulations of food and tartar. It should be soluble in the fluids of the mouth, and for most persons antacid. In mouths that are already alkaline — most likely to occur after middle life — the antacid ingredients may advantageously be omitted, and a powder employed possessing only mechanical qualities.

It is safe to affirm that a very large majority of persons err in the selection of a tooth-brush. Most of the brushes in the market are too stiff and too large. The habitual use of such brushes is attended with ill results. Again, those who are most solicitous to secure perfect cleanliness of the teeth are apt to err decidedly in a too vigorous use of the brush. Many sets of teeth have been ruined by too much or injudicious brushing. Skill and not force, faithfulness and not muscle, are required to secure the best results. Most persons scrub the outer surfaces of the teeth, as if to clean by *scouring* or friction were the object in using a brush. A *very moderate* application of a proper brush with a gentle frictional powder is sufficient for the external surfaces of the teeth, and is desirable in order to prevent the tendency to unsightly discolorations, but as a prevention of decay is the least useful mode of brush-

ing. Indeed, if the cleansing process is carried no further, this style of brushing does perhaps more harm than good, as it rubs particles of food and stringy mucus in between the teeth, and allows them to remain just where they are capable of producing the greatest mischief. The surfaces of the teeth which are exposed to the movements of the tongue, lips, and cheeks, being thereby protected, do not especially need brushing, except to remove stains, while the interstices, interspaces, fissures, depressions, and cavities are exposed to the deleterious action of the fermenting materials which naturally lodge there, to which are added the reinforcements carried by crosswise brushing. It should be remembered that the removal of accumulations of food or mucus from the depressions in the bicuspids and molars and from between the teeth is the essential. The brush should be moderately soft, the bristles long and elastic and of uneven lengths, so as to facilitate their introduction between the teeth. The upper teeth should be brushed downward and the lower teeth upward, both on the outer and inner surfaces, thus avoiding crowding the gums from off the necks of the teeth while tending to the dislodgment of any deposits between them. The articulating faces of the teeth should be brushed with the same care as the other surfaces — backward and forward and from side to side over the

grinding surfaces of the molars, so as to cleanse all the depressions.

Once daily is quite often enough to use a powder, and the best time is just before retiring. During the waking hours the various movements of the tongue and muscles of the mouth in speech and otherwise, the constant salivary secretion and the mastication of food, all tend to prevent the chemical changes which during sleep take place without hindrance. The morning cleansing may be properly performed with the aid of a little pure, mild soap, such as old Castile, or a reliable tooth-soap made expressly for the purpose; the latter will be all the more efficient if it contain an antiseptic such as creasote, carbolic acid, or salicylic acid. After meals it will be sufficient to use tepid water to which has been added a few drops of spirit of ammonia, or a little bicarbonate of soda, or lime-water — simply to neutralize any acidity. These after-meal cleansings should not involve a too vigorous use of the brush — merely a skilful dislodgment of adhering or impacted food is required. In fact, if the use of the brush leads to the *scrubbing* process, it would better be dispensed with, substituting a thorough rinsing of the mouth with tepid water, made slightly antacid, as suggested above. A muscular style of brushing five times daily will be injurious to the gums, if not to the teeth.

During the period occupied by the shedding and

replacement of the temporary teeth — say from five to fifteen years of age — it is difficult to keep the teeth clean or the mouth sweet and healthy. It is advantageous during this time, indeed at any period of life when an acid condition of the mouth is recognized, to use after the evening brushing a small quantity of precipitated chalk, rubbing it into the interstices of the teeth with the finger and allowing it to remain. The quantity need not be enough to be unpleasant; as much as would adhere to the end of a moistened finger is sufficient to counteract any acidity during the night.

The use of a *quill* toothpick after meals to dislodge particles of food from between the teeth is advisable, as is also the use of a strand of waxed floss silk passed between them at least once daily.

Such is the care suggested by the inestimable value of the teeth, and by their increasing tendency to early decay; but such care can hardly be hoped for until the public realize that to lose a tooth is a real misfortune, to extract one unnecessarily a crime. A perfect denture! How few understand the significance of the term! A set of thirty-two teeth in two unbroken arches — not one missing, not even one decayed tooth — the *beau ideal* of dental perfection. But the loss of a tooth, except in the front of the mouth, is not considered a serious matter by most persons, and the extent of the disaster is not appre-

ciated perhaps for years afterwards. Unquestionably, if all the various offices of the teeth were fully comprehended, the really small amount of attention which is required would be cheerfully bestowed.

As a frictional powder, precipitated chalk is a safe and generally efficient agent. Where this is found insufficient to prevent the staining or discoloration of the teeth, it may properly be combined in various proportions with the *inside* of the cuttle-fish bone, or with a smaller quantity of *very finely-powdered* pumice stone. In case the mouth is habitually alkaline, powdered orris-root combined with the cuttle-fish bone or pumice as above may be substituted for the chalk.

Mouth-washes should be used with reference to the existing conditions. Lime-water is recommended, in full strength, or more or less diluted where the mucous secretions are viscid or fetid; where the animal constituents are in excess of the earthy in the composition of the teeth; where there is special sensitiveness either of the dentine or of denuded roots, and where an antacid is needed to neutralize the action of acid medicines upon the teeth. In those cases where there is an evident tendency to rapid disintegration of tooth-structure, the daily use of lime-water as a mouth-wash is attended with beneficial results. Its unpleasant taste can be disguised by the addition of a small quantity of bruised licorice-root. The addition of a few drops of spirit of am-

monia to a tumblerful of water makes a convenient and efficient remedy for use on the brush, or as a mouth-wash where an antacid is indicated. For like purposes a half-teaspoonful or less of bicarbonate of soda to a glass of water is also efficient.

The injurious action of acid medicines upon the teeth should be counteracted by rinsing the mouth thoroughly with either of the foregoing washes immediately after swallowing the medicine. This immediate neutralization of the acid is much more trustworthy than the use of a tube, through which the medicine is often directed to be taken, and is advisable even in addition to the use of the tube.

The peculiarly disagreeable sensation described as having the teeth "set on edge," which results from taking acid fruits, foods, drinks, or medicines into the mouth, is caused by the action of the acid upon the enamel, perceptibly roughening its surface. This effect is injurious, and if frequently induced cannot but prove destructive even to perfectly sound teeth; being, however, specially objectionable in the case of teeth which have been filled, destroying the integrity of fillings by eroding the tooth-substance around their margins.

The tincture of krameria, mixed with an equal quantity of good *eau de Cologne* and diluted with water, makes an elegant and delightful astringent mouth-wash. Tincture of myrrh, so often pre-

scribed, is of questionable value as a mouth-wash, from the fact that the dilution of the tincture occasions a precipitation of the resin of which it is made about the necks of the teeth, aggravating rather than alleviating spongy conditions of the margins of the gums. An excellent mouth-wash for spongy and bleeding gums, to be used after the removal of the exciting causes, is made by combining one drachm of tannin, two drachms of chlorate of potash, and a pint of boiling water. A teaspoonful of the tincture of calendula to a goblet of water makes a pleasant and efficient mouth-wash for use after the removal of deposits about the teeth, or after extraction of teeth.

Perhaps no single article is more useful as a wash in various conditions of the mouth than phénol sodique — a preparation made from tar. It is an antacid, an astringent, a sedative, a styptic, an antiseptic, and a disinfectant. As a wash for the mouth it is highly useful (when there are no local exciting mechanical causes) in that class of cases of soft, spongy, swollen gums which bleed at the slightest touch. It checks excessive bleeding after extraction, and relieves the subsequent soreness of the gums. It gives prompt relief to the distressing pains which sometimes follow extraction; corrects unpleasantness of the breath caused by decayed teeth or by unhealthy secretions of the mouth, while its antacid and antiseptic properties make it a valuable agent in

correcting acidity and preventing putrefaction. It may be used, to meet varying indications, diluted more or less from half a teaspoonful to a tablespoonful in a tumblerful of water.

These suggestions are not intended to encourage a dependence upon any of the articles specified so much as to discourage the use of unsuitable dentifrices and washes, and especially of all advertised or secret preparations "warranted to harden the gums and whiten the teeth."

As suggested in previous chapters, more than usual care of the mouth is required during sickness. It will also be recognized that teeth need care in proportion as they are poorly organized or irregularly arranged.

The treatment of unhealthy conditions of the mouth, as shown in a predisposition to decay of the teeth, must, to be successful, be systemic as well as local; but, fortunately, that treatment is found most effective which is also indicated for the general good of the patient. It should include nutritious food, sunshine, sleep, change, tonics, etc., as are required alike for constitutional and local derangements.

CHAPTER XIX.

REPARATIVE TREATMENT.

THE first effort in the treatment of caries should be directed to the predisposing and exciting causes, constitutional and local. The object of treatment is the arrest of the destructive action, and the repair of the damage in the manner best calculated to preserve the tooth or teeth in a serviceable condition, and to protect them against a recurrence of the decay. It is, of course, desirable that the treatment be begun as soon as possible after the attack occurs, and before any considerable progress in the disintegration of the tooth-structure has been made. Very often a small orifice leads to an unexpectedly large interior cavity, and when the dentist is consulted the preservation of the tooth is almost or quite impossible. Sometimes a tendency to disintegration is manifested in all of the teeth, showing systemic derangement; sometimes it is limited to a pair of teeth, showing that constitutional conditions at the time of their formation have resulted in an imperfect texture, and consequently in a lessened capability of resisting the action of destruc-

tive agents; sometimes it is confined to a single tooth, in which case the explanation is probably to be found in its relations to the adjoining teeth.

When, owing to the character and progress of decay, and its appearance about the same time in teeth formed at different periods, there is reason to believe that it is an expression of constitutional disturbance, such systemic treatment should be adopted as will promote a healthy condition of the secretions of the mouth and of the soft tissues about the teeth. All deposits and accumulations of whatever character about the teeth should be carefully and thoroughly removed, and such local correctives employed as may be indicated, conjoined with the utmost care as to constant cleanliness. Any merely mechanical treatment of carious teeth which ignores their original organization, their special condition, and the temperament, age, and constitutional condition of the patient, is not likely to be successful. These are considerations which must always enter into the calculation in reference to methods of treatment. There is no greater folly than to demand the following of stated formulæ, prescribed manipulations, and an unvarying routine for every operation without regard to varieties of structure and character of decay. Whether to fill or file, with what and how much, must be determined by the dentist chiefly by the peculiarities of each case. Until the influence of such considerations is better

understood by the community unjust prejudices and conclusions will prevail. The relative cost of different materials and methods must also be considered, though the most costly operations are by no means always the best so far as the salvation of the teeth is concerned.

It is not proposed, however, to discuss here the relative value of special materials or methods. Though in one respect all who are worthy the name of dentist agree — viz., that their mission is not to remove and substitute, but to preserve and repair, yet, all the facts of experience which have been gathered, all the improved modes of practice which the best men in the profession have thus far developed, have not sufficed to establish a system the practice of which will infallibly prevent or arrest the progress of decay in human teeth. The most earnest and conscientious, the most experienced and accomplished operators disagree notably in their conceptions of what constitutes the best practice ; and with all the advantages of modern instruments, appliances, apparatuses, materials, and methods, they find their best efforts at times unsatisfactory alike to them and to their patients. It is, therefore, apparent that no rules can be laid down which will be applicable alike in all cases. The general reader cannot be expected to judge intelligently of questions on which the ablest and most observing practitioners of dentistry differ diametrically. The

practice of anticipating and so preventing, or of removing, superficial caries by so-called judicious separation of the teeth is ably and earnestly advocated, and also ably and earnestly denounced. Gold is generally considered the best material for permanent fillings — those intended to be permanent; though in many cases it is admitted that other materials are to be preferred. There are, however, many preparations of gold, having distinct and different qualities, and many methods of manipulating them, so that there are more differences even in gold fillings than would be conceived by those not familiar with the subject. Amalgam, gutta-percha, and various other plastic fillings have undoubted claims to consideration in many cases. The same is true of tin-foil. But patients are not ordinarily qualified to judge of the relative merits of the various materials and methods, nor of their special applicability in individual cases, and cannot do otherwise than to select an earnest, conscientious, intelligent dentist, and submit to his judgment — very certain to be better than their own — and having done so, to give him all the help in their power to secure the good results desired by both.

Good operations of any and all classes fail often because of a want of cleanliness on the part of the patient. If the teeth decay because of unhealthy conditions of the mouth, produced either by constitutional causes or from want of cleanliness, a contin-

uance of the same influences will produce like results after the most thorough and most conservative treatment according to any system. A tooth that has been filled or filed is not therefore to be supposed invulnerable to the attacks of destructive agents, and the dentist should not be held responsible for the patient's neglect. As a sick man requires more care than a well one, so a damaged tooth, even though repaired, needs more attention than a sound one.

CHAPTER XX.

SUBSTITUTION — ARTIFICIAL DENTURES.

WHEN the natural teeth have been lost, the deficiency should be supplied by substitutes. The comfort, the health, the speech, and the personal appearance of the individual will be promoted thereby, provided that the substitution is skilfully and artistically accomplished. Those who have parted with some of their teeth are inclined to set a higher value on those which remain, and supplying the place of the missing ones is often the best means of preserving the rest — preventing their elongation and irregularity. When the molars and bicuspids have been removed the front teeth are apt to project, presenting an unsightly appearance. This may to a great extent be prevented by supplying artificial masticating surfaces.

There are various bases for artificial dentures — gold, platinum, porcelain, silver, rubber, celluloid, etc. Which of these materials is the best in a given case depends upon a variety of circumstances — the extent and character of the loss to be supplied, the

age and physical characteristics of the patient, the condition of the mouth, the special qualifications of the dentist, and the length of the patient's purse. No one of the bases named is always the best; each of them has peculiar fitness for special cases. No authoritative opinion governing all cases can therefore be given. As a general rule, however, it may be affirmed that a gold base has more advantages and fewer disadvantages, certainly for partial sets, than any other material.

The time most favorable for the insertion of artificial teeth is as soon after the loss of the natural ones as the state of the mouth will allow, and before the muscles of expression have been suffered to lose their natural action. It is the modification which these muscles undergo after the extraction of the teeth which causes the changed and unnatural appearance of the mouth and face when a considerable time elapses before the natural teeth are substituted by others. Their prompt replacement will also tend greatly to prevent the elongation or protrusion from their sockets of the teeth which formerly occluded with the missing ones.

The most important office of artificial teeth, as well as of natural ones, is the mastication of food. The proper performance of this function is indeed essential, and frequently the skill of the dentist is rewarded by a restoration to health of those whose

imperfect mastication previous to the insertion of artificial teeth had entailed upon them all the evils of indigestion.

The sense of fatigue in the jaws and muscles of the face, caused by inability to close the mouth properly, in the absence of opposing or occluding teeth, is also overcome by the skilful substitution of artificial teeth. The enunciation is likewise improved, in many cases being made as perfect as before.

Sometimes, in the case of elderly people who have lost their teeth, there is a modification of the lower jaw which causes it to interfere with the auditory apparatus in such a manner as to produce partial or absolute deafness, which the insertion of a properly constructed denture promptly relieves. Another advantage gained by the wearing of artificial teeth is that they act as a dam in preventing the sudden emptying of the column of air in the mouth in speaking — explained in the chapter on "The Mouth."

The modification of the features caused by the removal of the supports of the lips and cheeks is, of course, changed by the insertion of artificial teeth; but whether the change is an improvement or otherwise depends upon the artistic perceptions of the dentist. It is unquestionable that the majority of the dental profession have given more thought and labor to the best methods of restoring impaired functions — securing comfort, usefulness, and durability

in artificial dentures — than to the important question of correlation of the substitutes with the general physical characteristics of the patient. To this account is to be charged the unseemly incongruities constantly staring the observer in the face from mouths whose natural organs have been replaced in disregard of the universal law of *correspondence.* No matter how anatomically correct or how skilfully adapted for speech and mastication an artificial denture may be, if it does not bear the relation demanded by age, temperament, facial contour, etc., its artificiality will be apparent to every beholder. This law of correlation running through nature attracts and enchants us in an infinite diversity of manifestations. The failure in art to recognize its demands is correspondingly abhorrent to our sensibilities. This law of correspondence, apparent throughout the organism, establishes a harmony between the teeth and other physical characteristics by which we are led to infer their size, shape, color, and structure. A broad and square or an oval face; a large, coarse-featured man, or a delicately organized woman; a miss of eighteen, or a matron of fifty; a brunette or a blonde — these and other varieties present as many differing types, with teeth corresponding in size, shape, color, and density. If, then, teeth correlated in their characteristics to those which nature assigns to one class be inserted in the mouth of one whose physical or-

ganization demands a different style, the effect cannot be otherwise than displeasing to the eye, whether the observer be skilled in perception or only intuitively recognizes inharmony without understanding the cause. It is entirely possible, by the study of æsthetic anatomy, for the skilled dental mechanician to adapt teeth to the great varieties of facial expression, to avoid offending the eye trained to observe nature, and to add to usefulness the charm of beauty. Incongruity or want of proper expression in a set of teeth shows either malpractice in him by whom they were selected and arranged, or dictation on the part of the patient.

But, important as are the æsthetics of substitution, use and comfort are mainly to be considered. An artificial denture must be properly constructed and skilfully adapted, or it will be worse than useless. Badly-fitting plates cause serious affections not only of the soft tissues of the mouth, but frequently of the hard palate and of the jaws. However correct artificial teeth may be in their æsthetic relations, however comfortable and useful, let no one be beguiled into a willing sacrifice of the natural teeth for the sake of the greater comeliness of substitutes, or because the latter cannot ache. The best set of artificial teeth that ever was made is so far inferior to an average natural denture that the two can only be contrasted, not compared.

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